14.5 Master Plan Lists of Projects

14.5.1 Government Proposed 1992/2002 Highway Projects

The Egyptian Government has approved the current 1992/1997 Third Five Year Plan, which includes the allocation of public investment for some highway projects. Because of budget constraint, this list of projects will be considered in the present study so that recommendations concerning priorities and scheduling of the current and following plans could be elaborated. Also, RBA and other governmental agencies had proposed more projects than those accepted by the Ministry of Planning in the current five year plan. These other projects will be considered also in the present study in the 1997/2002 Fourth Five Year Plan.

The list of projects accepted in the current third five year plan are given in Table 14-5-1. The table groups the projects of the Ministry of Transport separately from those of the Ministry of Development. The total number of MOT is 14, of which 7 projects are for bridge construction, and 6 in Ministry of Construction, of which 2 projects are bridge construction. The lengths are 1,312Km and 775Km respectively. For the definition of the locations of the project in the network, the individual projects given in Table 14-5-1 have been represented on a location topographic map for the year 1992 as illustrated in Figs. 14-5-1 (a) and (b).

Table 14-5-2 lists the other projects proposed by RBA and other governmental agencies and not accepted in the current five year plan. The serial numbers of the projects in Table 14-5-2 start where the serial numbers of Table 14-5-1 end and the serial numbers of bridges start after the serial numbers of highway sections. MOT projects include 9 highway and 4 bridge projects and Ministry of Development projects include 2 highway projects. The total length of MOT highway projects is 1,049Km and that of Ministry of Development is 485Km. Figs. 14-5-2 (a) and (b) defines the location of each project.

The projects mentioned in the two previous tables are proposed mostly for land use development and have been accepted as components of basic highway master plan.

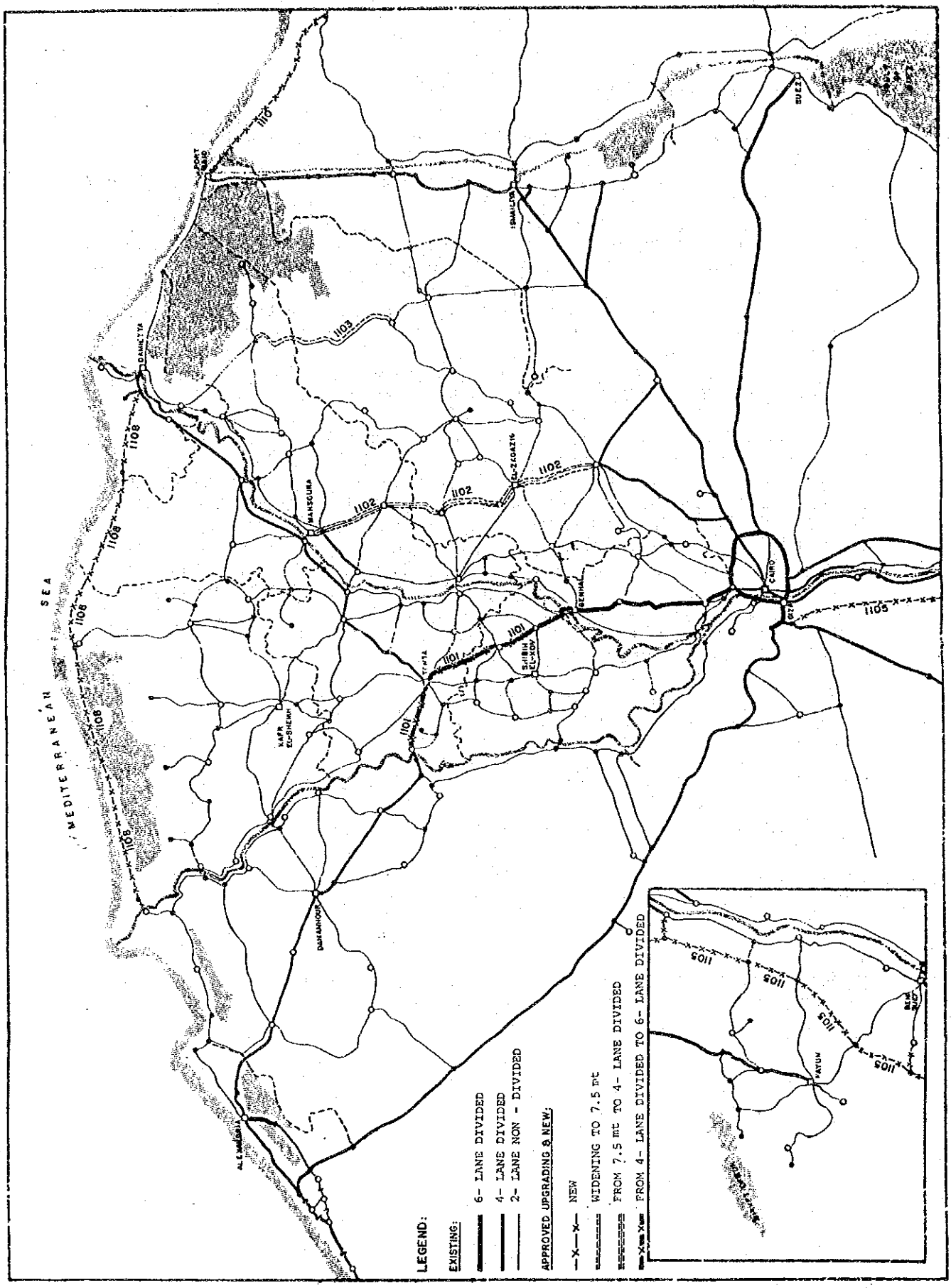


Figure 14-5-1 Location Map of the Approved Third Five Year Plan Highway Projects. a) Lower Egypt

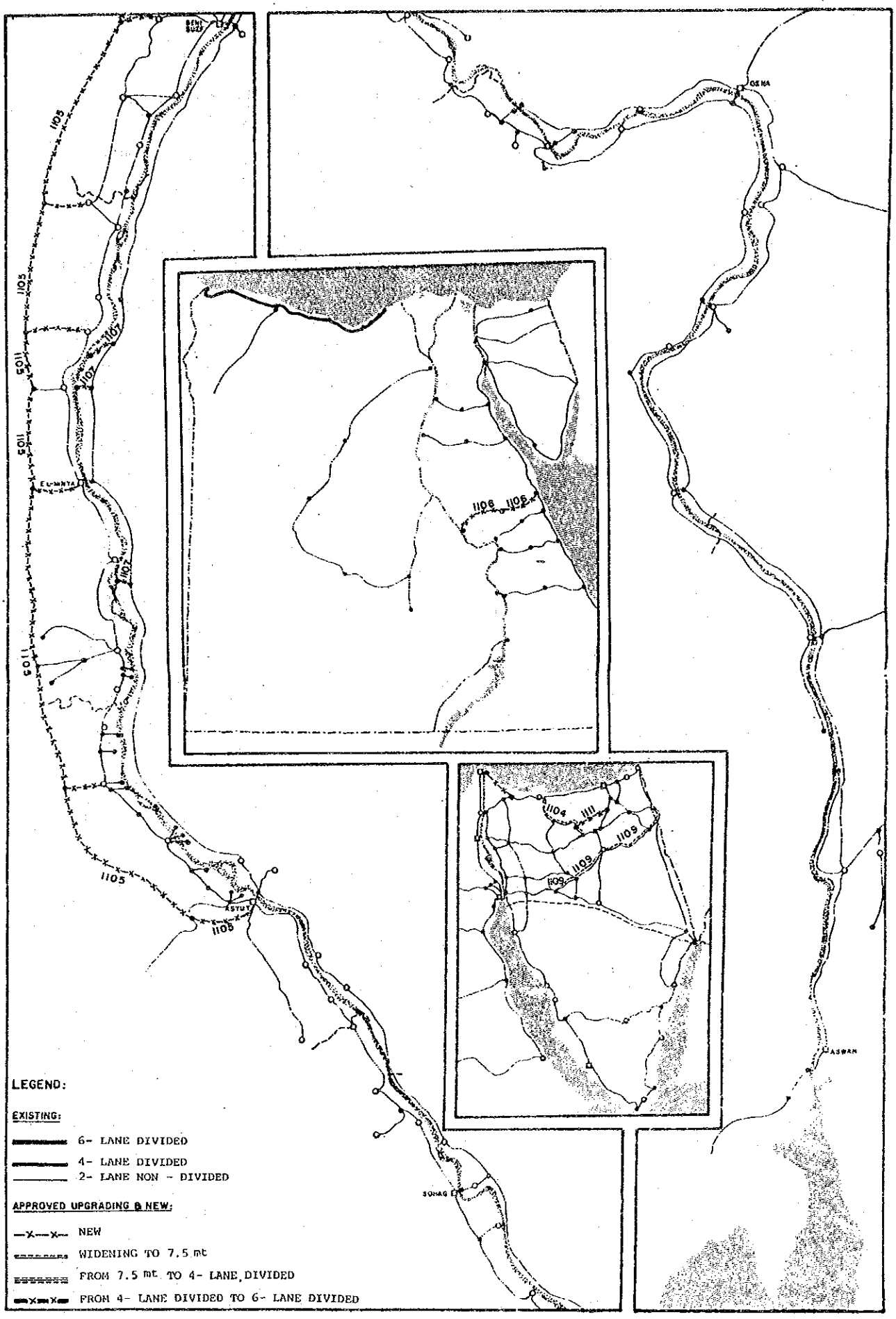


Figure 14-5-1 Location Map of the Approved Third Five Year Plan Highway Projects. b) Upper Egypt

Table 14-5-1 : Description of the Highway Projects Accepted in the Third Five year Development Plan

Project Ser.No.	Section Name (Km)	Length (KM)	Existing Condition	Upgraded To
Ministry of Transport :				
a) Highways :				
101	Berket El Sabe-Kafr El Zayat	54.0	7.5 mt,4-lanes,Divided	10.5 mt,6-lanes,Divided
102	Belbies-Sandoub	76.5	7.5 mt,2-lanes,Dual	7.5 mt,4-lanes,Divided
102	Sandoub-El Mansoura	3.5	6.0 mt,2-lanes,Dual	7.5 mt,4-lanes,Divided
103	El Gamalia-El Hesanya	42.0	6.5 mt,2-lanes,Dual	7.5 mt,2-lanes,Dual
	El Badary-El Nawawrah	30.0	7.5 mt,2-lanes,Dual	(*)
	El Dakhla-El Farafra	200.0	7.5 mt,2-lanes,Dual	(*)
104	Beir El Abd-Elmaghara-Beir El Homa	101.0	6.0 mt,2-lanes,Dual	7.5 mt,2-lanes,Dual
105	Beg. Cairo/Fayoum At Giza To Asuit	525.0	NEW	7.5 mt,2-lanes,Dual
	El Aiyat Con.		(**)	7.5 mt,2-lanes,Dual
	Ihnasya Con.		(**)	7.5 mt,2-lanes,Dual
	Sumusta Con.		(**)	7.5 mt,2-lanes,Dual
	El Iduwa Con.		(**)	7.5 mt,2-lanes,Dual
	Matai Con.		(**)	7.5 mt,2-lanes,Dual
	El Minya Con.		(**)	7.5 mt,2-lanes,Dual
	El Qusiya Con.		(**)	7.5 mt,2-lanes,Dual
106	El Hawawish(Sohag)-El Ghardaga	240.0	NEW	7.5 mt,2-lanes,Dual
107	El Sh. Hassan-El Sh. Has. Con.	15.0	NEW	7.5 mt,2-lanes,Dual
107	Bani Khalid-Bani Khalid Con.	15.0	NEW	7.5 mt,2-lanes,Dual
107	Bani Hassan-Bani Hassan Con.	10.0	NEW	7.5 mt,2-lanes,Dual
	Surface crossing layout improvement			
	By-Passes around Urban Areas			
	1991/1992 Completion Porjects			
b) Bridges :				
124	Asuit Nile Bridge		6.0 mt,2-lanes,Dual	7.5 mt,4-lanes,Divided
125	Zifta Nile Bridge		7.5 mt,2-lane,Dual	7.5 mt,4-lanes,Divided
126	Aiyat Rail Bridge		NEW	7.5 mt,4-lanes,Divided
127	Kafr El Zayat Bridge		7.5 mt,4-lanes,Divided	10.5 mt,6-lanes,Divided
128	Faraskour Bridge		NEW	7.5 mt,4-lanes,Divided
129	El Mansoura Bridge		NEW	7.5 mt,4-lanes,Divided
130	Luxor Bridge		NEW	7.5 mt,4-lanes,Divided
Subtotal		1312.0		
Ministry of Housing :				
a) Highways :				
108	Rashid-Kafr El Batiekh	150.0	NEW	7.5 mt,2-lanes,Dual
109	Sedr El Hetan-El Aoga	152.0	6.0 mt,2-lanes,Dual	7.5 mt,2-lanes,Dual
110	Port Fouad-Romanah	45.0	NEW	7.5 mt,2-lanes,Dual
111	El Maghara-El Serr	40.0	NEW	7.5 mt,2-lanes,Dual
	El Farafrah-Bahria Oasis	180.0	7.5 mt,2-lanes,Dual	(*)
	Ras Gharib-Safaga	208.0	7.5 mt,2-lanes,Dual	(*)
b) Bridges :				
131	Rashid Bridge		NEW	7.5 mt,2-lanes,Dual
132	El Borollous Bridge		NEW	7.5 mt,2-lanes,Dual
Subtotal, Ministry of Housing:		775.0		
Total		2087.0		

(*) Reconstruction of the Section Included in the Third Five-Year Plan,but not Considered as Upgrading or New Projects & Project Serial Number have been Skipped.

(**) Lengths & Costs Included With Project No.5 as these Links are Connectors of the Giza/Asuit Highway to the Existing Highway Road Network.

(***)Capacities and Traffic Volumes for Dual Highways Are in Both Direction,While for Divided Highways for Each Direction.

Table 14-5-2 : Description of Other Highway Projects Proposed by Governmental Agencies other than Those in the current Five Year Plan.

Project Ser.No.	Route Section Name	Length (KM)	Existing Condition	Upgraded To
Ministry of Transport				
a) Highway				
112	Ismailiya-Suez	83.0	7.5 mt,2-lanes,Dual	7.5 mt,4-lanes,Divided
113	Shakshouk-Qutah	43.0	NEW	7.5 mt,2-lanes,Dual
114	Hoo-El Rayaina	60.0	NEW	7.5 mt,2-lanes,Dual
115	El Hamoul-Balteem	40.0	6.0 mt,2-lanes,Dual	7.5 mt,2-lanes,Dual
117	Km112 Cairo/Ism.Des.-El Zagazig	80.0	6.0 mt,2-lanes,Dual	7.5 mt,4-lanes,Divided
118	Qena Rail Br.-Luxor	62.0	7.5 mt,2-lanes,Dual	7.5 mt,4-lanes,Divided
119	Aga-Benha	61.0	7.5 mt,2-lanes,Dual	7.5 mt,4-lanes,Divided
	El Khatatba-Wardaan	13.0	7.5 mt,2-lanes,Dual	(*)
120	Quseir-Bernice	286.0	6.0 mt,2-lanes,Dual	7.5 mt,2-lanes,Dual
121	Bernice-Halayeb	321.0	NEW	7.5 mt,2-lanes,Dual
b) Bridge				
133	Aswan Nile Bridge		6.0 mt,2-lanes,Dual	7.5 mt,4-lanes,Divided
134	Sherbin Nile Bridge		6.0 mt,2-lanes,Dual	7.5 mt,4-lanes,Divided
135	Sherbin Rail Bridge		NEW	7.5 mt,4-lanes,Divided
136	Qena-Qena Rail Bridge		NEW	7.5 mt,4-lanes,Divided
Subtotal,Ministry of Transport:		1049.0		
a) Highway				
22	El Fath(Asuit)-Red Sea	250.0	NEW	7.5 mt,2-lanes,Dual
23	Manqbad Con.(Asuit)-Tenida	235.0	NEW	7.5 mt,2-lanes,Dual
Subtotal,Ministry of Housing		485.0		
Total		1534.0		

(*) Reconstruction of the Section Included in the Third Five-Year Plan,but not Considered as Upgrading or New Project & Project Serial Number have been Skipped.

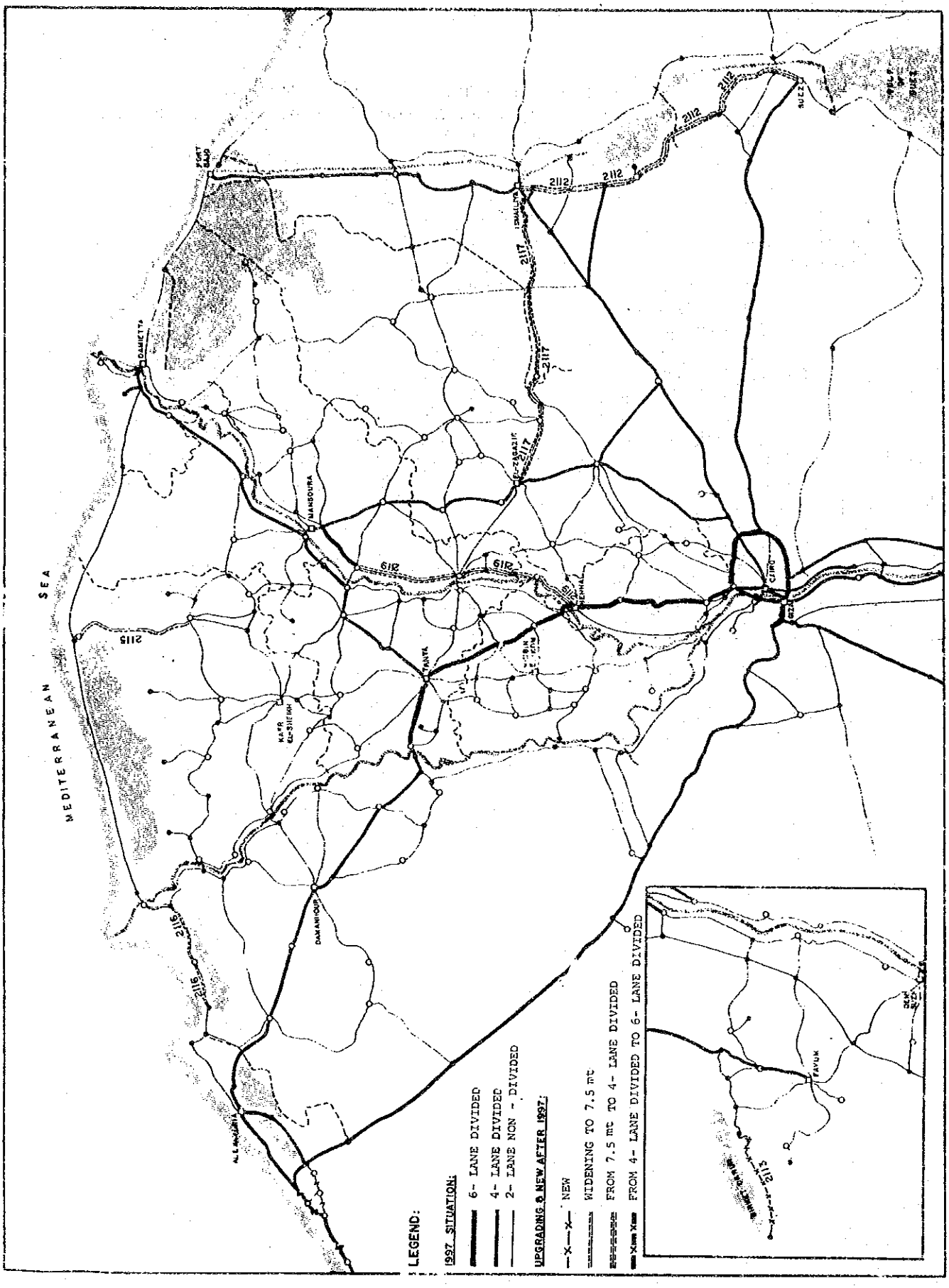


Figure 14-5-2 Location Map of the Other Projects Proposed by Governmental Agencies and not scheduled in the Third Five Year Plan. a) Lower Egypt

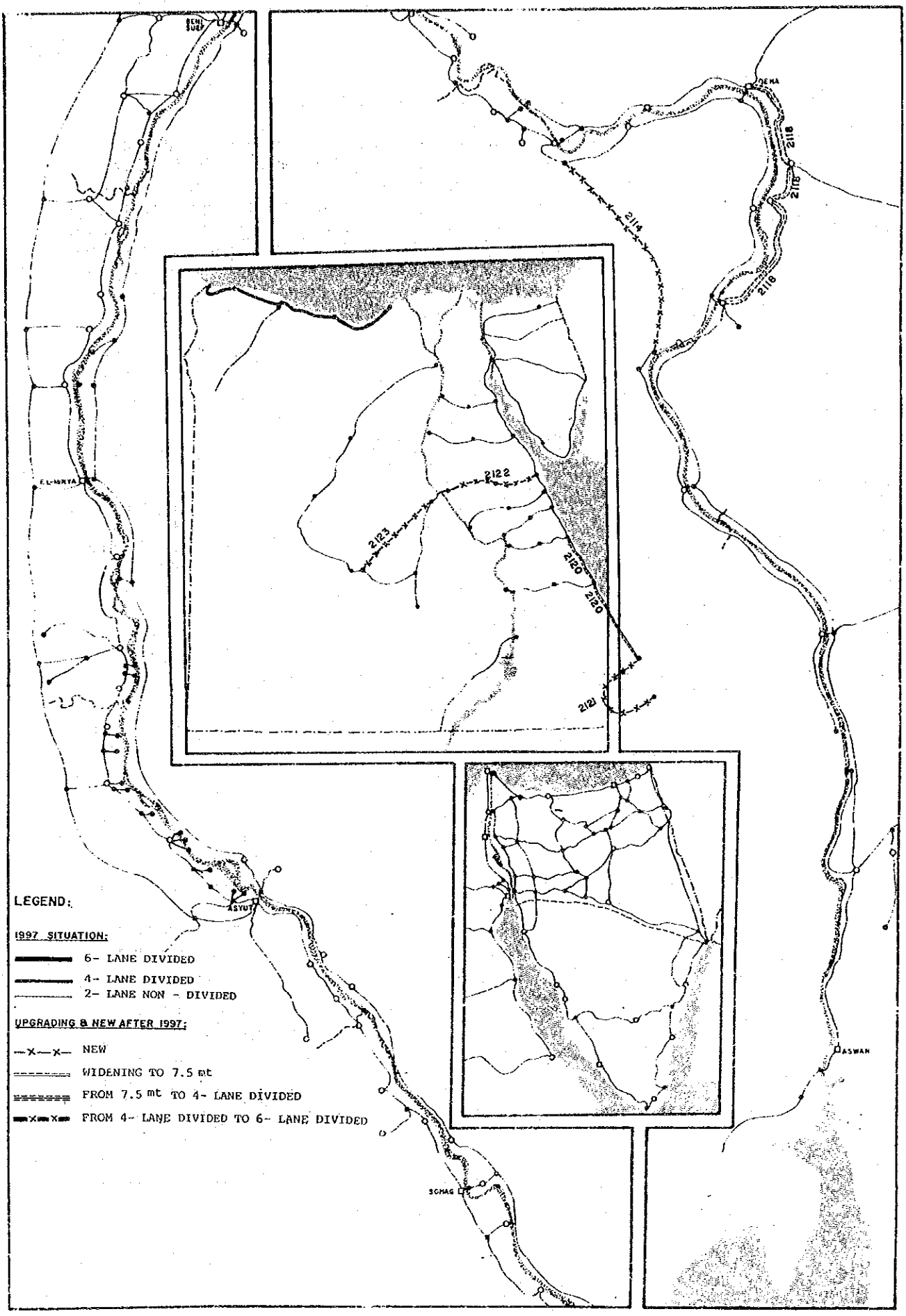


Figure 14-5-2 Location Map of the Other Projects Proposed by Governmental Agencies and not scheduled in the Third Five Year Plan. b) Upper Egypt

14.5.2 Projects to Maintain Level of Service

Using the future OD matrices for the years 1997, 2002 and 2012, assignment runs with the basic 1992 network including the governmental proposed projects for the years 1997 and thereafter have been carried out. The network used for the assignment run for the year 1997 includes only the projects financed in the current Third Five Year Plan, while the networks used for the years 2002 and 2012 includes, in addition, the other projects proposed by governmental agencies and not accepted in the current Third Five Year Plan.

The loaded networks for the years 1997, 2002, and 2012 obtained from these assignment runs have been scanned for all links having a V/C ratio more than the optimum value (equals 0.62). The links having a V/C ratio more than 0.62 have been upgraded to the next higher class to cope with the predicted increase in traffic by the corresponding target year. Tables 14-5-3, 14-5-4, and 14-5-5 include detailed information about the links which need upgrading for the target years 1997, 2002 and 2012 respectively. Figs. 14-5-3 through 14-5-5 gives the location of the upgrading projects for the target years 1997, 2002, and 2012. The target inter city network will be that presented in Fig. 14-5-6.

Table 14-5-3 Upgraded Links for the Year 1997, Case (V/C) Not More than the Optimum Value 0.62

Pro. No.	Route Section Name	Length (Km)	Existing Condition	Required Upgrading Condition
1	Kafr El Zayat Br.-Alex.	104.0	7.50mt, 4-Lane, Divided	10.5mt, 6-Lane, Divided
10	El Qanater El Kha.-Sentres	14.0	6.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
6	Sharkawia(mans.)-Sandoub	4.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
12	Zagazig-Faqous	38.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
8	Kafr El Sheikh-Desouk	32.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
8	Desouq Br.-Damanhour	16.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
7	Zifta-El Azizia	16.5	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
13	Zifta-Tanta	25.0	6.00mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
4	Belbes-Zagazig	18.0	7.50mt, 4-Lane, Divided	10.5mt, 6-Lane, Divided
14	Abu Kebir-Kafr Saqr	9.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
5	El Tawfikia/Khat-Damanhour Branch	41.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
5	Damanhour Branch-Om Denar	2.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
15	L.B.Alex.-Rashied	33.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
2	Haikestep-Belbes	32.0	7.50mt, 4-Lane, Divided	10.5mt, 6-Lane, Divided
11	El Tawfikia-El Brigat	35.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
9	Shubra El Kheima-El Qanater El Kha.	14.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
TOTAL		118.0		

Table 14-5-4 Upgraded Links for the Year 2002, Case (V/C) Not More than the Optimum Value 0.62

Pro. No.	Route Section Name	Length (Km)	Existing Condition	Required Upgrading Condition
20	El Abassa-Belbes	22.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
10	Sentres-El Bagour	15.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
10	Metubus-Edfina	2.0	6.00mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
6	El Qanater El Kha.-Benha	31.0	6.00mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
6	El Qanater El Kha.-Qalyub	9.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
6	Qalyub-El Sharkawia	6.0	6.00mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
8	Dekernes-Menyet El Nassr	6.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
8	Belkas-Kafr El Garaida	7.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
13	El Zagazig-Meet Ghamr	30.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
4	El Zagazig-El Mansaura	56.5	7.50mt, 4-Lane, Divided	10.5mt, 6-Lane, Divided
14	El Mehalla El Kubra-Samanoud	6.5	7.50mt, 4-Lane, Divided	10.5mt, 6-Lane, Divided
14	Qutur-El Mehalla El Kubra	22.0	6.00mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
15	Alexandria-El Bousily	52.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
19	Edfina-El Bousily	14.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
24	Qutur-Qellin	16.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
21	El Hesanya-El Salhia	10.5	6.50mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
11	El Brigat-Imbaba	73.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
11	El Marg-Shubra El Qanater	23.5	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
18	Tanta(2)-Basyun	23.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
22	Kafr El Sheikh-Mehalla Ku.	26.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
16	Atfih-El Saff	18.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
23	Sharkawia(Mans.)-Dekernes	17.6	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
17	Car./Ism.-Ism./Suez Rd. Ent.	4.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
9	Shubra El Kheima-El Qanater El Kha.	14.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
3	Beg. Cairo/Alex.D.-Nozha Air Port	205.0	7.50mt, 4-Lane, Divided	10.5mt, 6-Lane, Divided
41	Dar El Salam-Qan. Nag. Hamaad	20.0	N.A	7.50mt, 2-Lane, Dual
TOTAL		227.0		

Table 14-5-5 Upgraded Links for the Year 2012, Case (V/C) Not More than the Optimum Value 0.62 (1)

Pro. No.	Route Section Name	Length (Km)	Existing Condition	Required Upgrading Condition
10	El Bagour-Kotour	65.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
10	Sidi Salem-Shalaama	12.0	6.50mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
12	Tamlay(Brigat Br.)-Benha Br.	43.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
8	El Gamalia-Manzala	6.0	6.50mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
35	Meet Abu Khalid-Sh. El Qan.	39.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
32	Shebin El Kom-Quesna	11.0	7.00mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
5	El Tawfekia/Kha.-Damanhour Branch	41.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
5	Damanhour Branch-Damanhour	10.0	N.A	7.50mt, 4-Lane, Divided
15	El Bousily-Rashid	5.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
30	Giza-Imbaba	7.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
19	Desouq Br.-Menyat El Said	24.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
34	Desouq-Basyun	22.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual

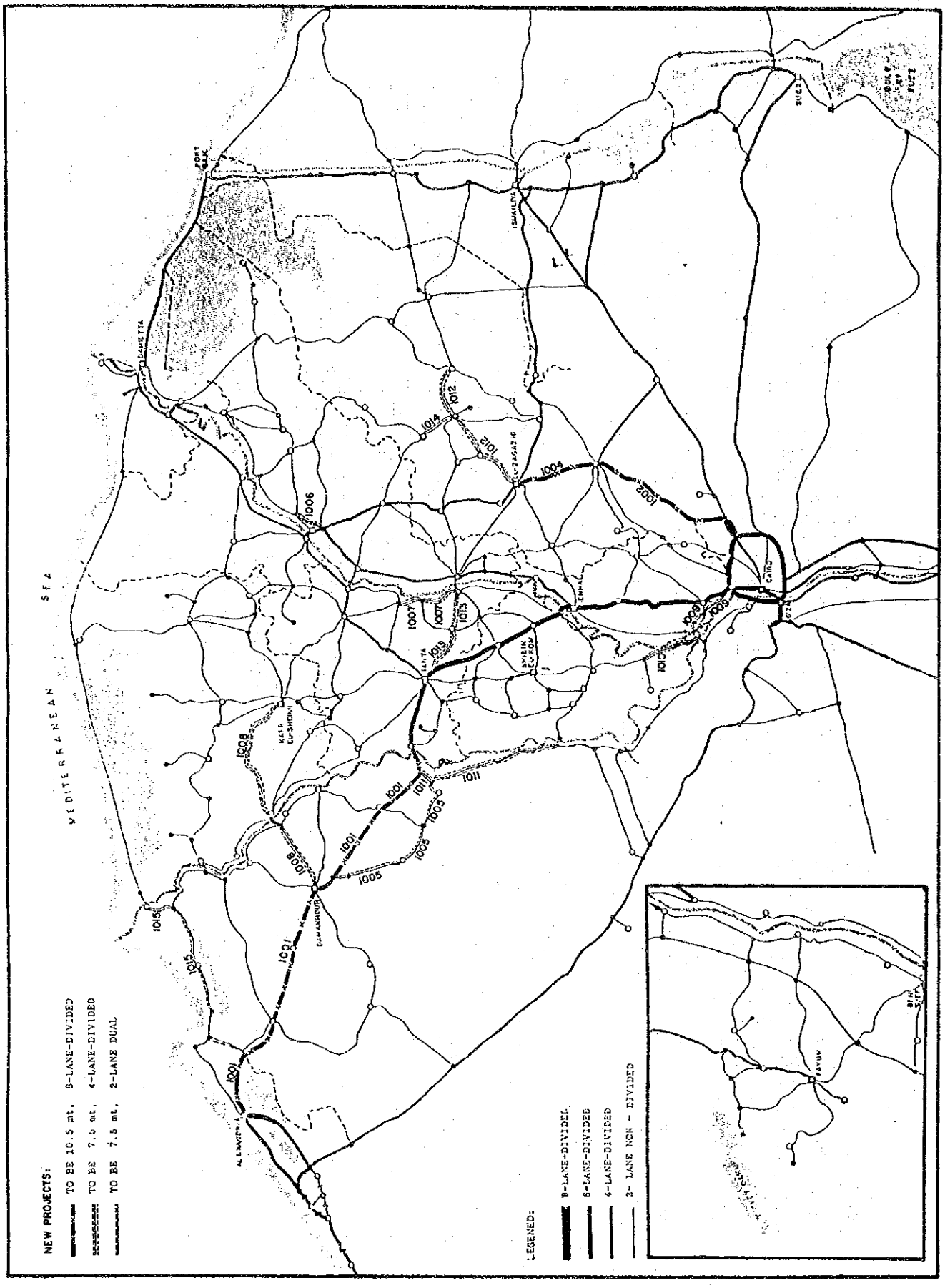


Figure 14-5-3 Location of Upgraded Links for 1997 on 1992 Base Map. a) Lower Egypt

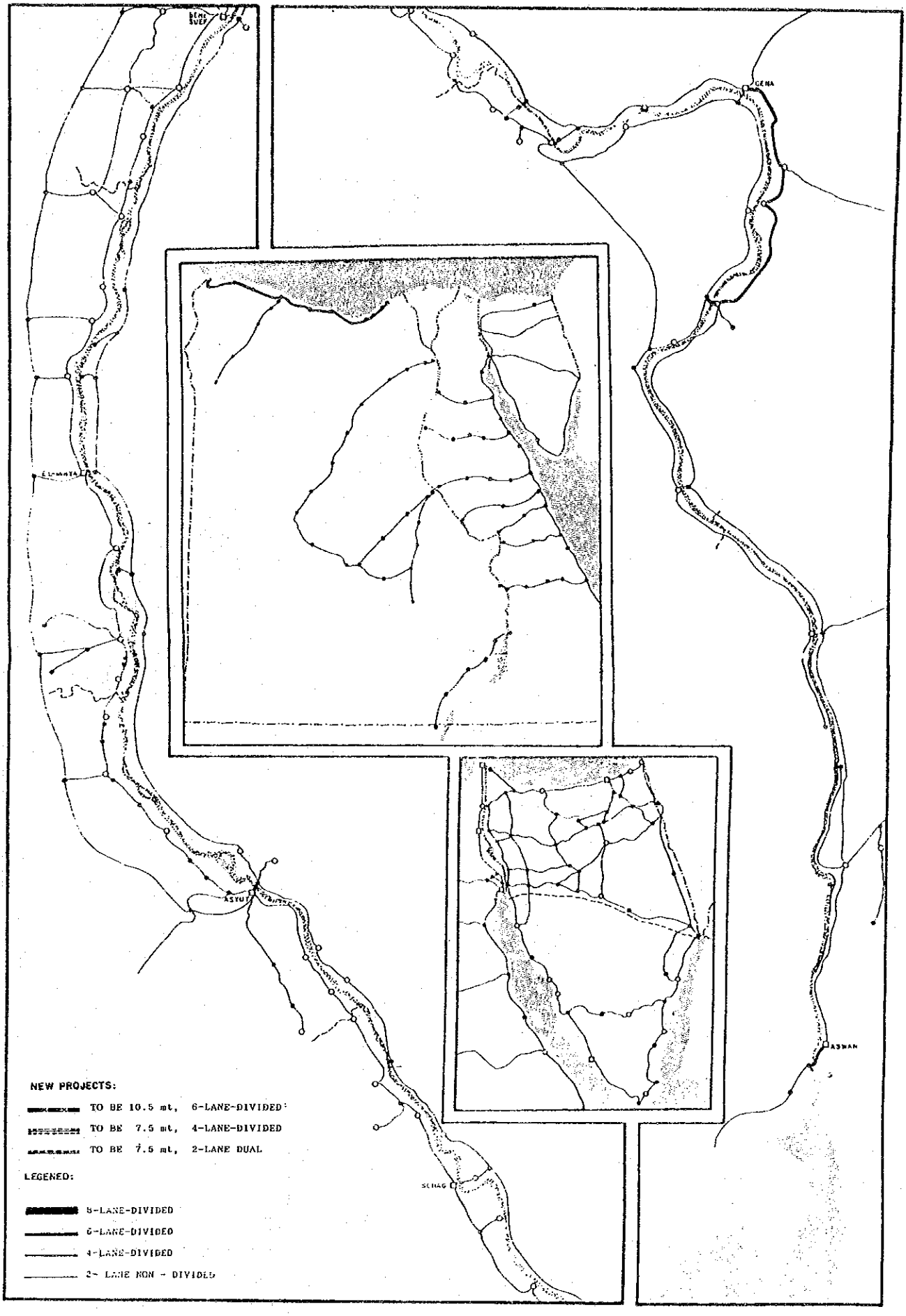


Figure 14-5-3 Location of Upgraded Links for 1997 on 1992 Base Map. b) Upper Egypt

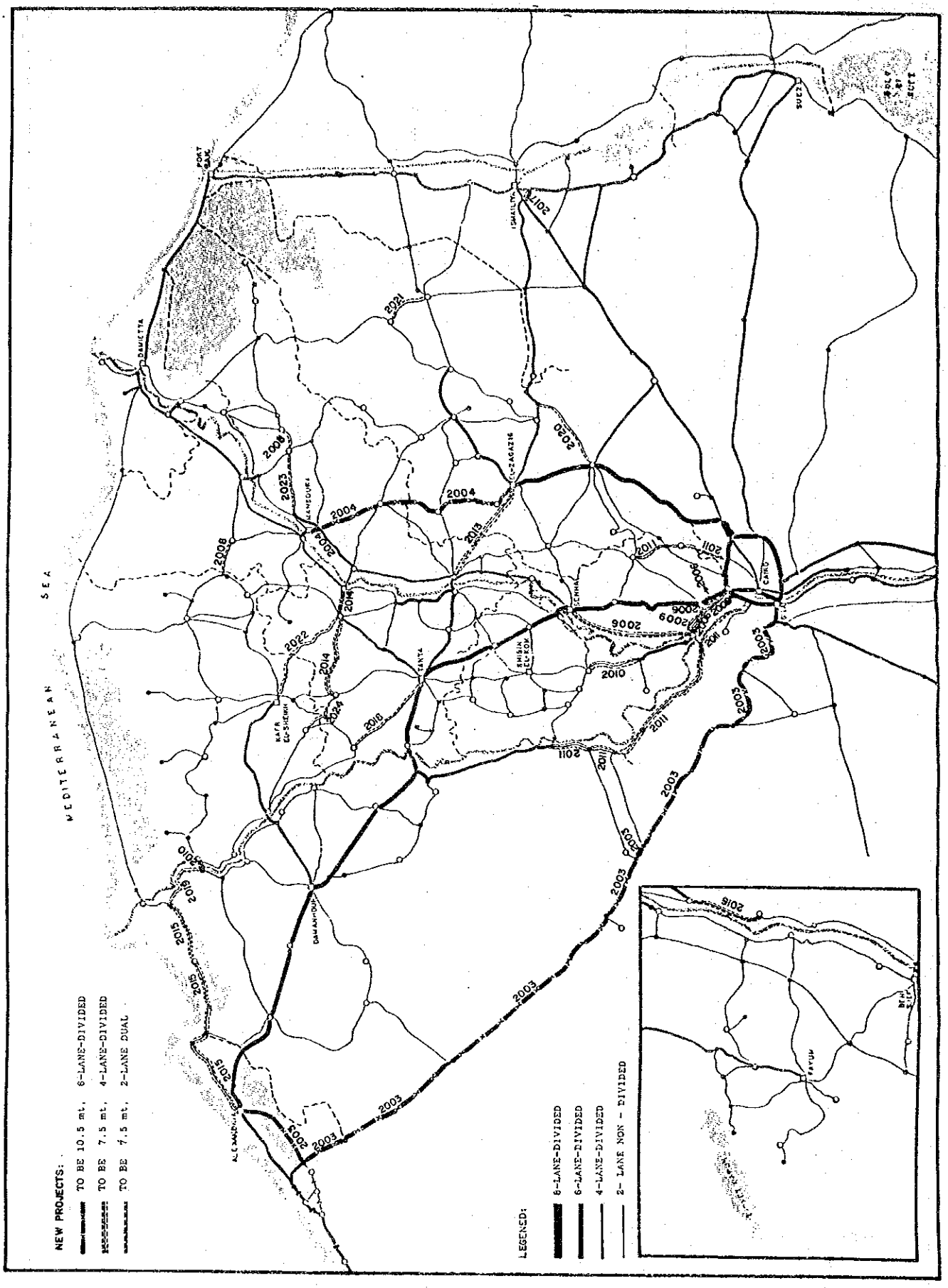


Figure 14-5-4 Location of Upgraded Links for 2002 on 1997 Base Map. a) Lower Egypt

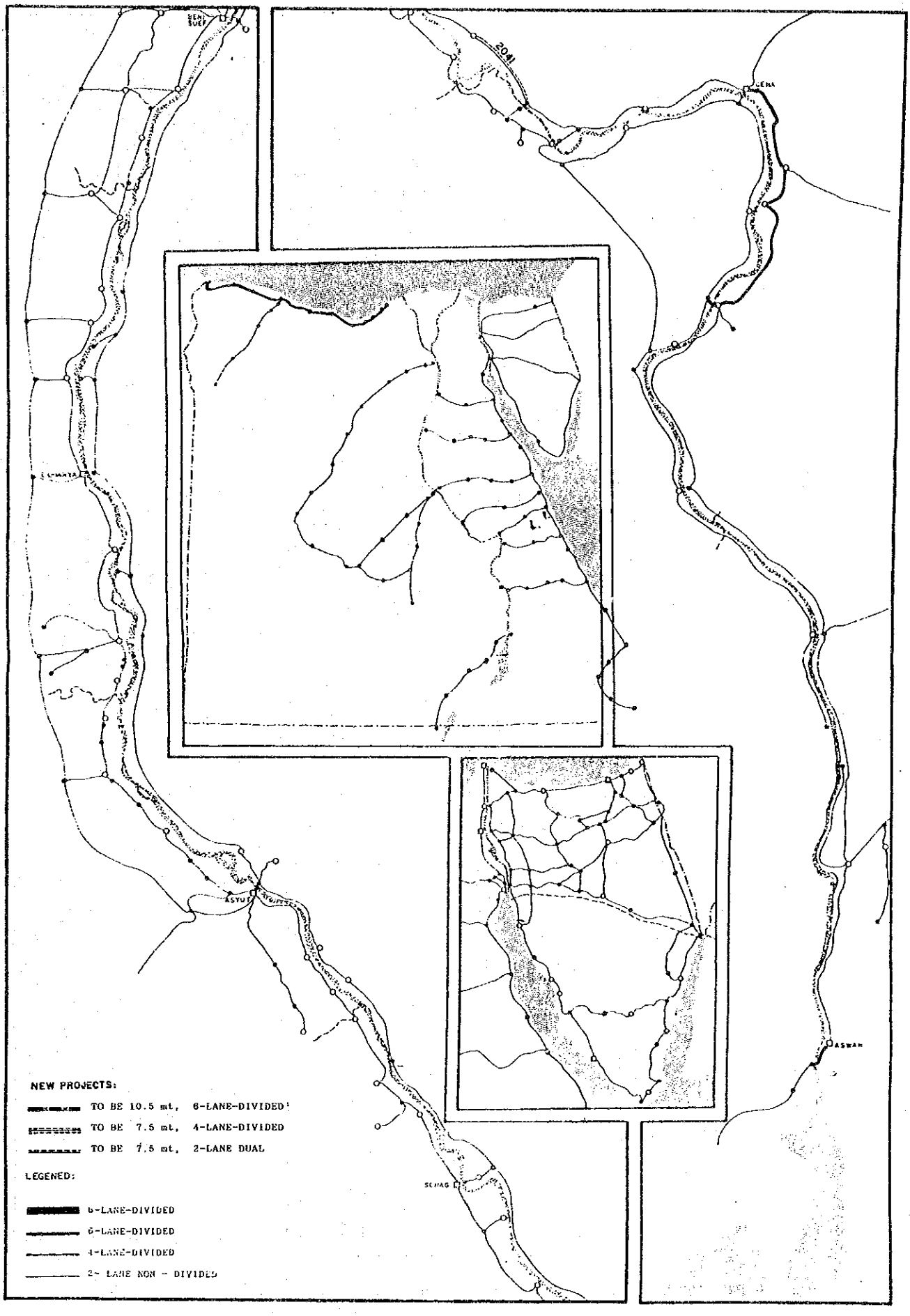


Figure 14-5-4 Location of Upgraded Links for 2002 on 1997 Base Map. b) Upper Egypt

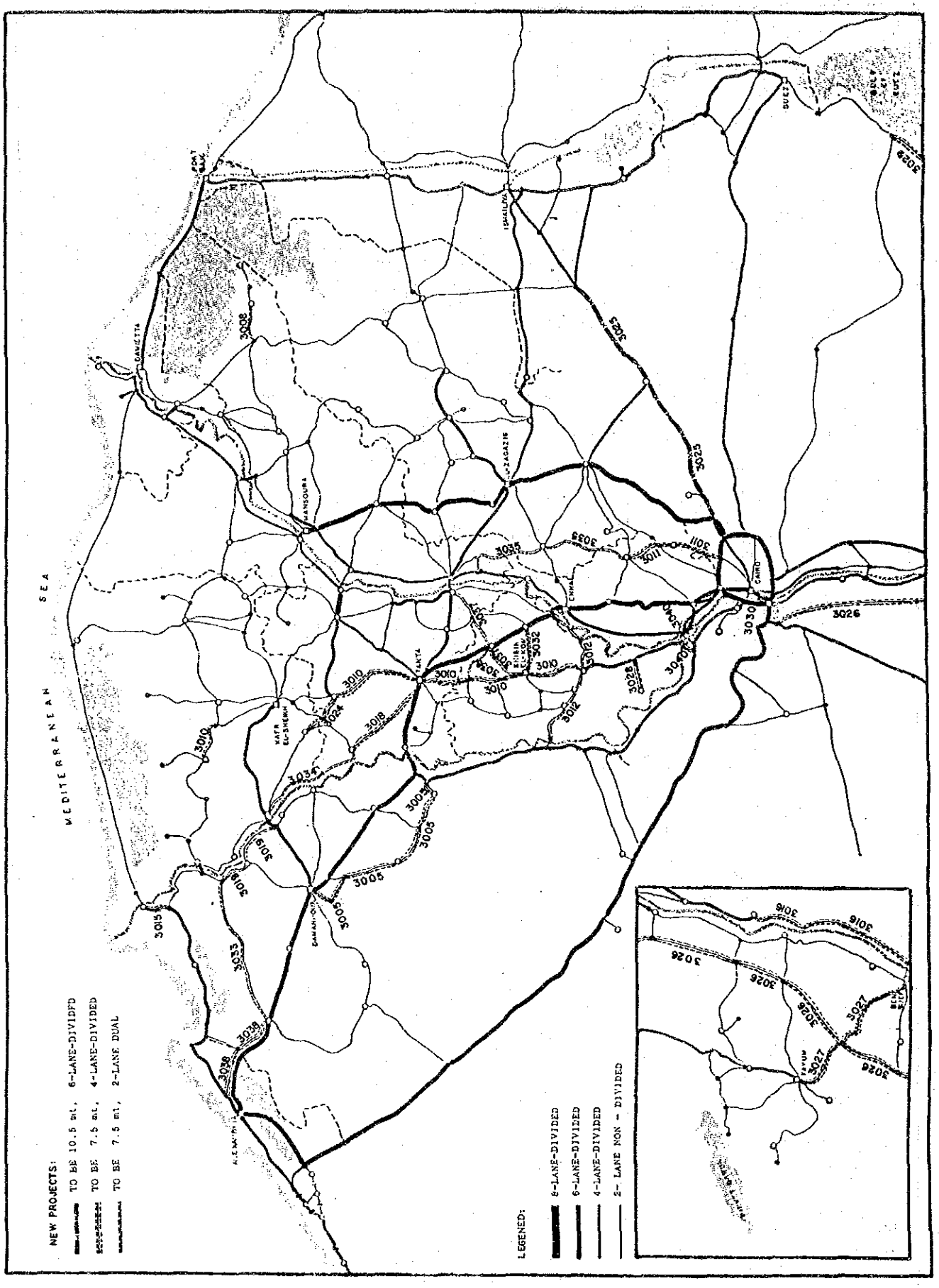


Figure 14-5-5 Location of Upgraded Links for 2012 on 2002 Base Map. a) Lower Egypt

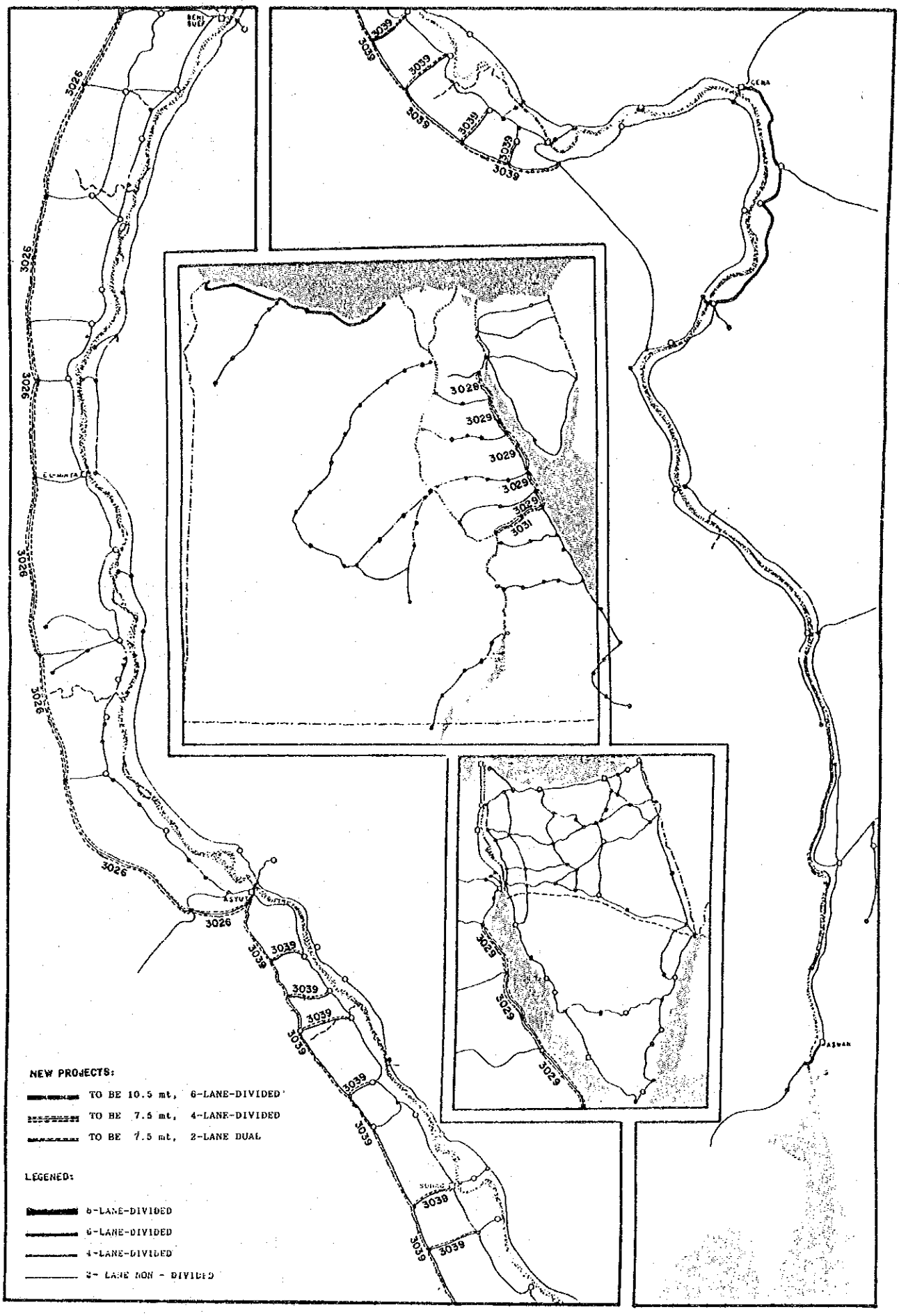


Figure 14-5-5 Location of Upgraded Links for 2012 on 2002 Base Map. b) Upper Egypt

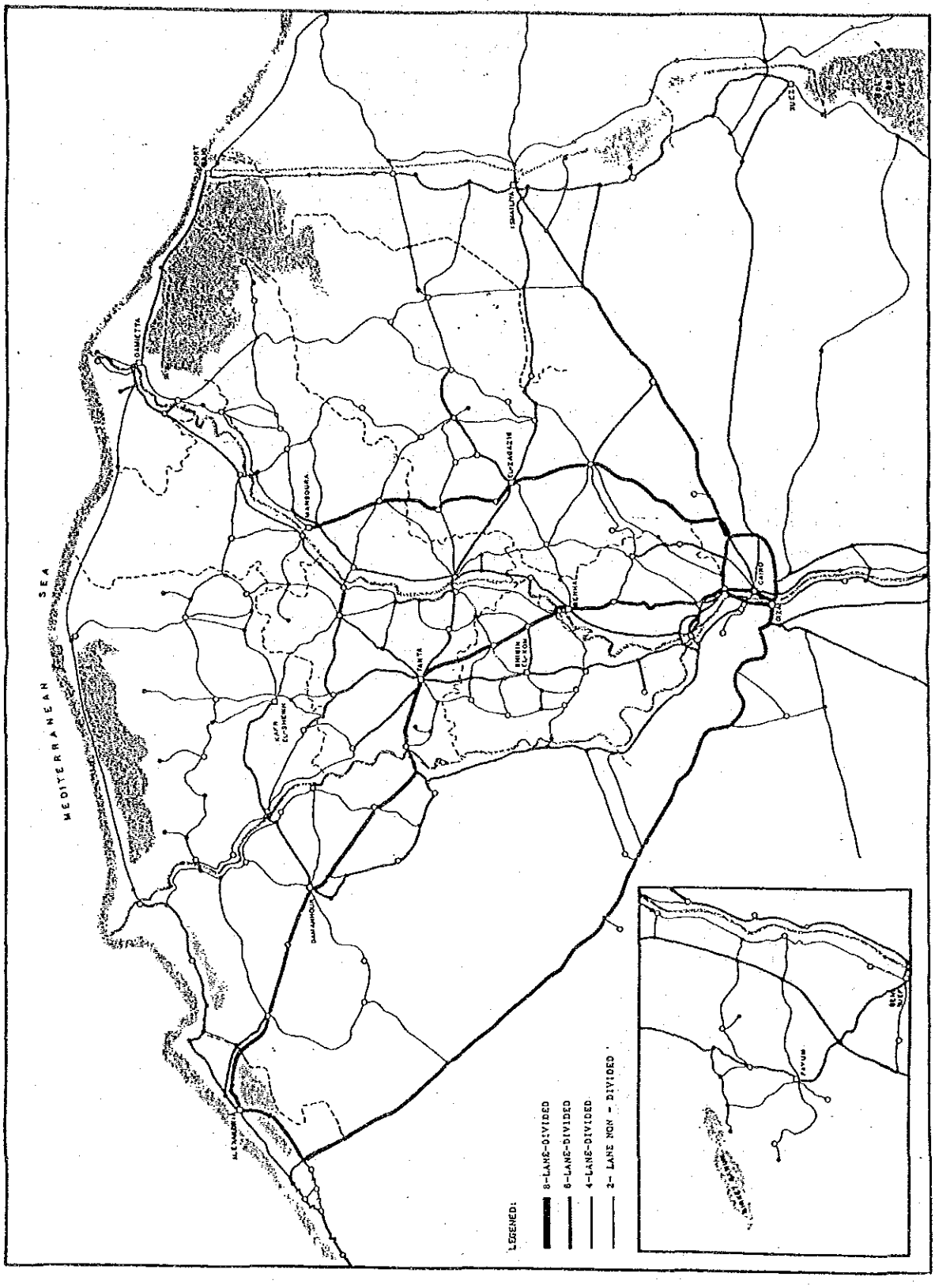


Fig. 14-5-6 Year 2012 Long Term Targeted Inter City Highway Network

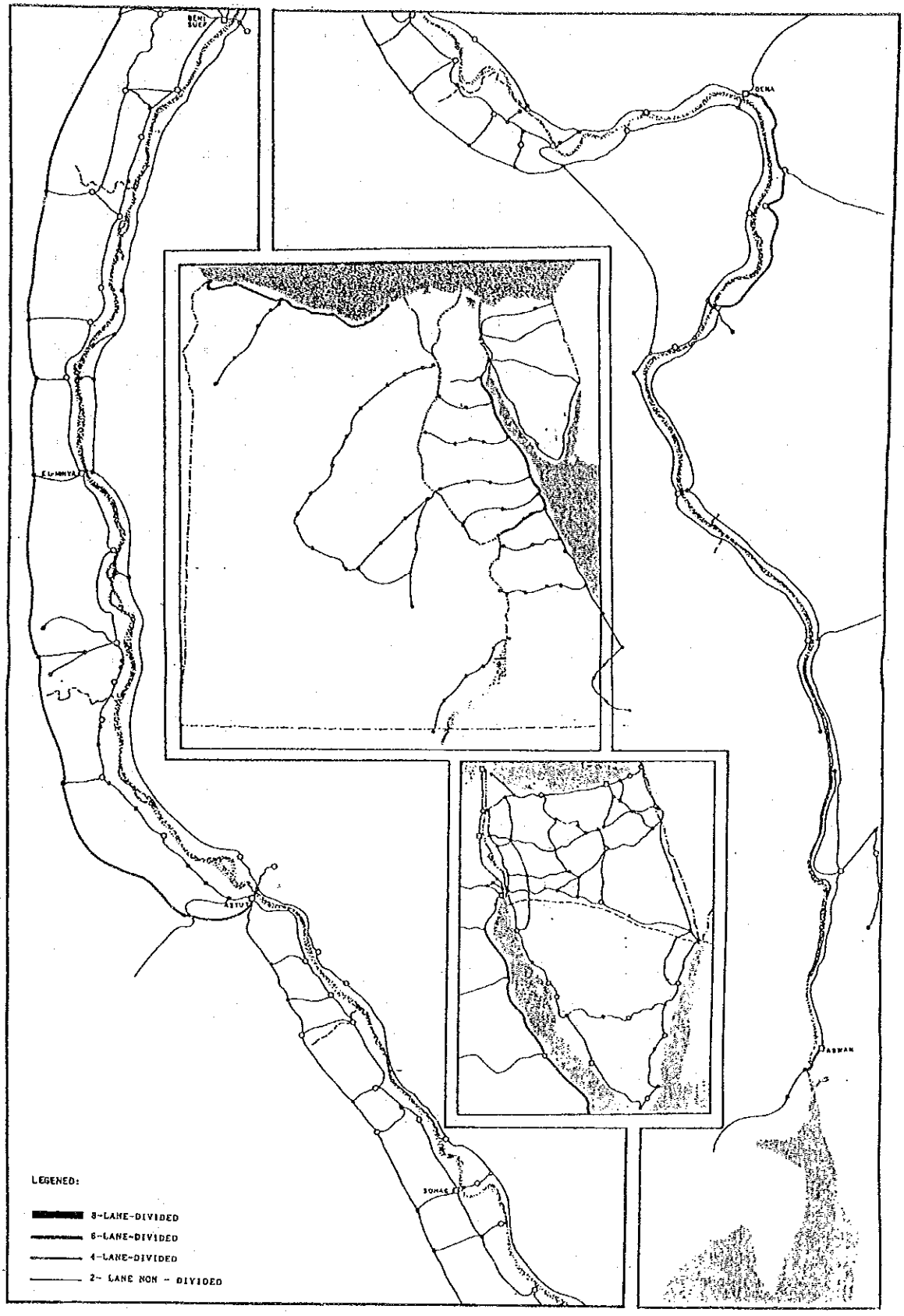

BENI SUEF
QENA
ASYUT
SOHAG
ASWAN
LEGENED:
8-LANE-DIVIDED
6-LANE-DIVIDED
4-LANE-DIVIDED
2- LANE NON - DIVIDED

Table 14-5-5 Upgraded Links for the Year 2012, Case (V/C) Not More than the Optimum Value 0.62 (2)

Pro. No.	Route Section Name	Length (Km)	Existing Condition	Required Upgrading Condition
27	El Fayoum-Bani Suef	44.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
24	Qutur-Qellin	16.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
37	Zifta-Sh. El Kom	30.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
11	El Marg-Sh. El Qanater	23.5	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
28	Sentres-Ashmoun	8.0	7.00mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
18	Tanta(2)-Basyun	23.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
29	Elain El Sokhna-Safaga	399.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
16	Atfih-Beni Suef Br.	39.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
31	Qena-Safaga	165.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
25	Haikstep-Km85(Cairo/Ism.)	61.0	7.50mt, 4-Lane, Divided	10.50mt, 4-Lane, Divided
33	Kafr El Dawar-Menyt El Said	37.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
40	New Bridge(Qanater El Kh.)	6.5	N.A.	7.50mt, 4-Lane, Divided
26	Beg. Cai./Fay.-Asyut	389.0	7.50mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
38	Kafr El Dawar-Abis	13.0	6.00mt, 2-Lane, Dual	7.50mt, 4-Lane, Divided
38	Abis-Alex.(2)	13.0	N.A	7.50mt, 4-Lane, Divided
36	Babel-Berkit El Saba	11.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
39	Asyut-El Ghanayim	45.0	6.00mt, 2-Lane, Dual	7.50mt, 2-Lane, Dual
39	El Ghanayim-Hoo	139.0	N.A.	7.50mt, 2-Lane, Dual
39	El Balaizah-Abu Tig	9.0	N.A.	7.50mt, 2-Lane, Dual
39	Sidfa Con.-Sidfa	9.0	N.A.	7.50mt, 2-Lane, Dual
39	El Ghanayim-Tima	10.0	N.A.	7.50mt, 2-Lane, Dual
39	El Talihat-Tahta	7.0	N.A.	7.50mt, 2-Lane, Dual
39	Sohag Con.-Sohag	8.0	N.A.	7.50mt, 2-Lane, Dual
39	El Sakaria-El Minshah Con.	8.0	N.A.	7.50mt, 2-Lane, Dual
39	Dawoud Sahal-Girga	10.0	N.A.	7.50mt, 2-Lane, Dual
39	Abidous-El Balyana	12.0	N.A.	7.50mt, 2-Lane, Dual
39	Ezbet El Bousah-Abu Tisht	9.0	N.A.	7.50mt, 2-Lane, Dual
39	El Dahsa-Farshut	6.0	N.A.	7.50mt, 2-Lane, Dual
TOTAL		1835.0		

14.5.3 Operational Evaluation of the Master Plan Lists of Projects

To evaluate the master plan list of projects for the years 1997, 2002, and 2012, three assignment runs for the WITH-PROJECTS cases and three runs for the DO-NOTHING cases have been carried out. The three WITH-PROJECT cases use the 1997, 2002, and 2012 OD matrices with the future optimum highway networks for the three target years including the projects proposed from governmental agencies as well as the upgrading projects proposed from the study team. The 1997 DO-NOTHING assignment run uses the 1992 base network with the 1997 OD matrix. The 2002 DO-NOTHING assignment run uses the future proposed 1997 network with the 2002 OD matrix. Finally, the 2012 DO-NOTHING run uses the 2002 future proposed network with the 2012 OD matrix. The results of these assignment runs are summarized in Table 14-5-6, which includes the results of these six runs and also the results of the assignment run for the base year 1992.

Table 14-5-6 Operational Evaluation of the Proposed Master Plan List of Projects and Comparison with the Level of Service at the 1992 Base Year

Descriptions	1992	1997		2002		2012	
	Base Year	Do-Nothing	with Projects	Do-Nothing	with Projects	Do-Nothing	with Projects
1 (2) Link Length (Km)	15,888	15,888	17,153	17,153	18,660	18,660	20,195
2 (4)Peak Hour PCU's Trips	44,340	69,743	69,743	88,110	88,110	104,970	104,970
3 (7) Total PCU-Hr	76,293	159,252	141,548	202,020	179,718	248,189	217,486
4 (8) Total PCU-Km (x1000)	4,958.8	8,955.9	8,791.1	11,367.3	11,180.5	14,094.9	13,958.0
5 (9) Average Speed Km/Hr	65.00	56.24	62.11	56.27	62.21	56.79	64.18
6 (10) Average Tr. Time (Min)	103.24	137.00	121.77	137.57	122.38	141.86	124.31
7 (11) Average Tr. Length (Km)	111.83	128.41	126.05	129.01	126.89	134.28	132.97
8 (12) Average V/C	0.43	0.59	0.53	0.61	0.53	0.61	0.52
9 Percent of Length							
Level of Service A	59	33	38	25	35	21	31
Level of Service B	22	16	15	22	20	22	22
Level of Service C	10	13	19	13	28	24	34
Level of Service D	7	23	27	18	13	21	10
Level of Service E	2	16	1	22	5	13	3

The total link lengths is proposed to be increased from 15,888 km in 1992 to 20,195 Km in the year 2012. In these figures, the lengths of the one-way links are counted twice while the dual two-way links are counted once. The total number of PCU trips will increase from 44,340 in the rush hour in 1992, to 104,970 trips in 2012. So, the network total length will increase in the period 1992/2012 by 27.1% while the total PCU will increase by 136.7% from their values in 1992. This shows that the lightly trafficked links in 1992 will be heavily used in 2012.

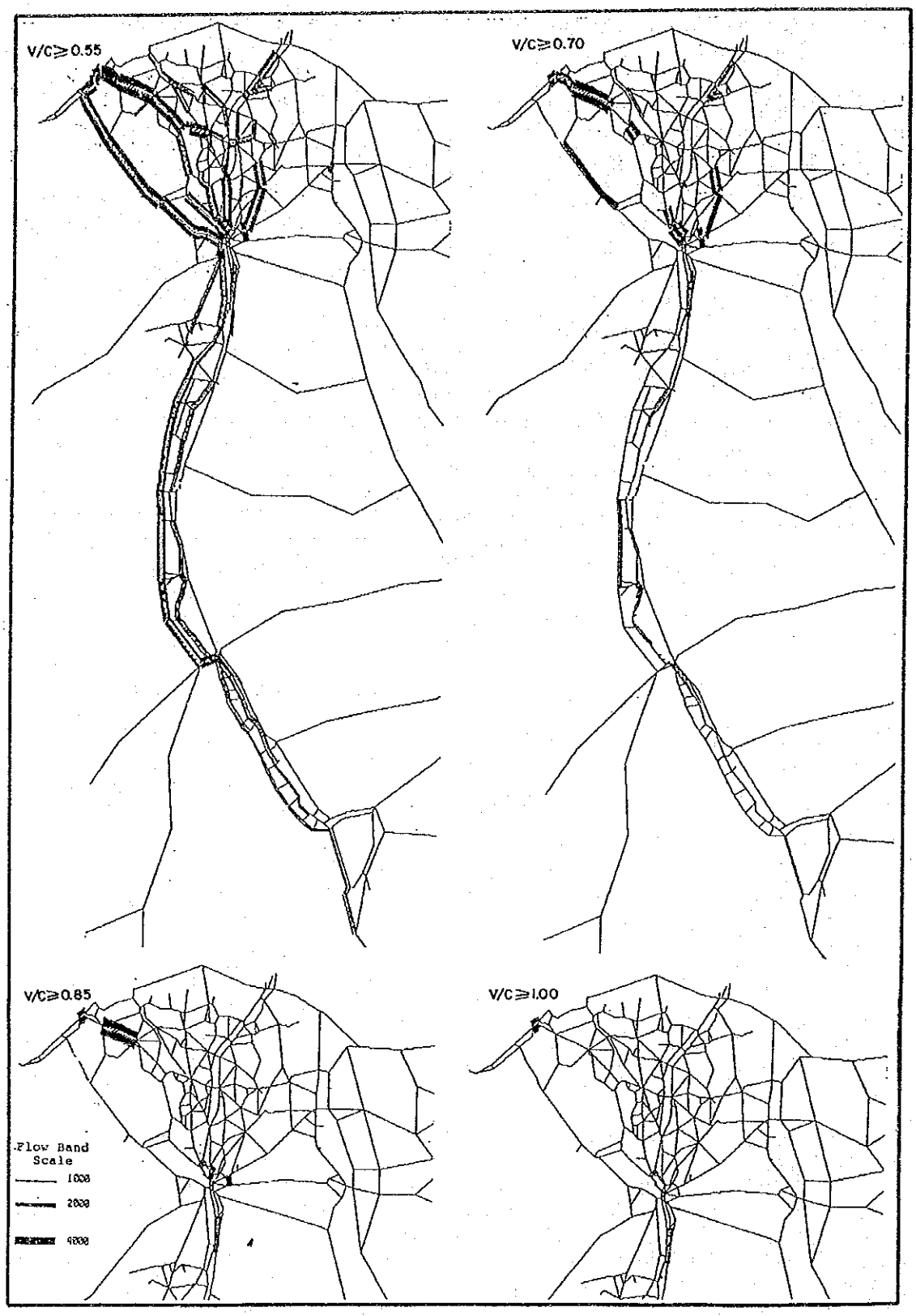


Fig. 14-5-7 Link Overloading Conditions for the WITH-PROJECT Proposed Inter City Highway Network for the 2012.

The overall operational evaluation of the 2012 WITH-PROJECTS loaded network compared with the 1992 base year one, indicates that the total PCU-Hrs will increase from 76.23 thousands to 217.49 thousands i.e. by 185% of its value in 1992. The total PCU-Km will increase from 4.96 million to 13.96 million, i.e. 181% from its value in 1992. The average speed has little dropped from 65.00 Km/h to 64.18 Km/h, i.e. by 1.2%. The average trip time in the same period will increase from 103.2 min. up to 124.3 min., i.e. by 20.4% corresponding to an increase of the trip length from 111.8 Km to 132.1 Km, i.e. by 18.9% which matches very well the small drop in the average speed. On the contrary, the average V/C will increase from 0.43 up to 0.52 i.e. by 21.1% from its value in 1992. This shows better utilization in 2012 of the spare capacity of the lightly loaded links in 1992.

The PCU-Km running under level of service E in the years 1997, 2002, and 2012 are 1%, 5%, and 3% respectively compared to 2% for the year 1992. The PCU-Km running under level of service A+B+C are 72%, 83%, and 86% for the years 1997, 2002, and 2012 respectively compared to 91% of the base year 1992. However, the PCU-Km running under level of service A are 38%, 35%, and 31% for the years 1997, 2002, and 2012 respectively compared to 59% for the year 1992. The reason for such drop is that the spare capacity for the lightly loaded links in the year 1992 is decreasing with time.

The level of service for the intermediate years for the WITH-PROJECTS proposed optimum networks is little less than that for the ultimate target year 2012. This is reflected in the average speeds and also in the percentage of PCU-Km running under level of service D&E which is 28% for the year 1997, and 18% for the year 2002 compared to only 9% in the year 1992. This percentage will be reduced again to 13% in 2012. However, the 1997 and 2002 indices show that the level of service in the intermediate years will be reduced further than that prevailing in 1992 if, due to reasons of budget constraints, some of the projects proposed to respond for the increase of traffic in the periods 1992/1997/2002 are scheduled at later periods.

For the link overloading conditions for the target 2012 proposed basic network, the 1997, 2002 and 2012 loaded networks have been scanned for links having V/C ratios equal or more than 1.00, 0.85, 0.70, and 0.55. The results of this scanning are represented graphically in Fig. 14-5-7. It is clear that almost no link has a V/C ratio more than 1.00, and very few links have V/C ratio equal or more than 0.85. This link overloading conditions is similar to the conditions prevailing in 1992.

The operational evaluation and the link overloading diagrams show that the WITH-PROJECTS developed master plan lists till the year 2012 will keep the network level of service almost

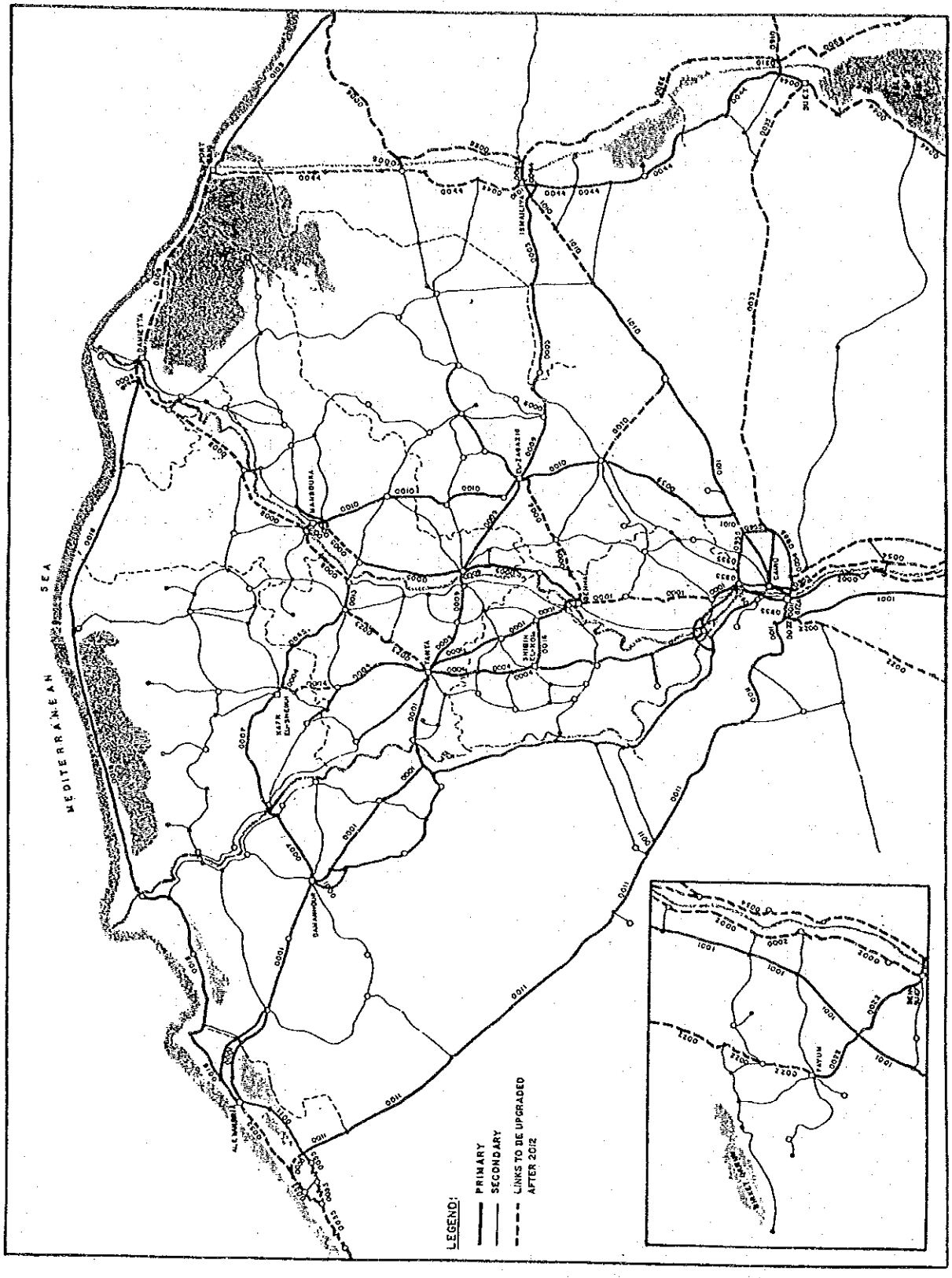


Fig. 14-5-8 Links in the Primary Network to be Upgraded after 2012. a) Lower Egypt

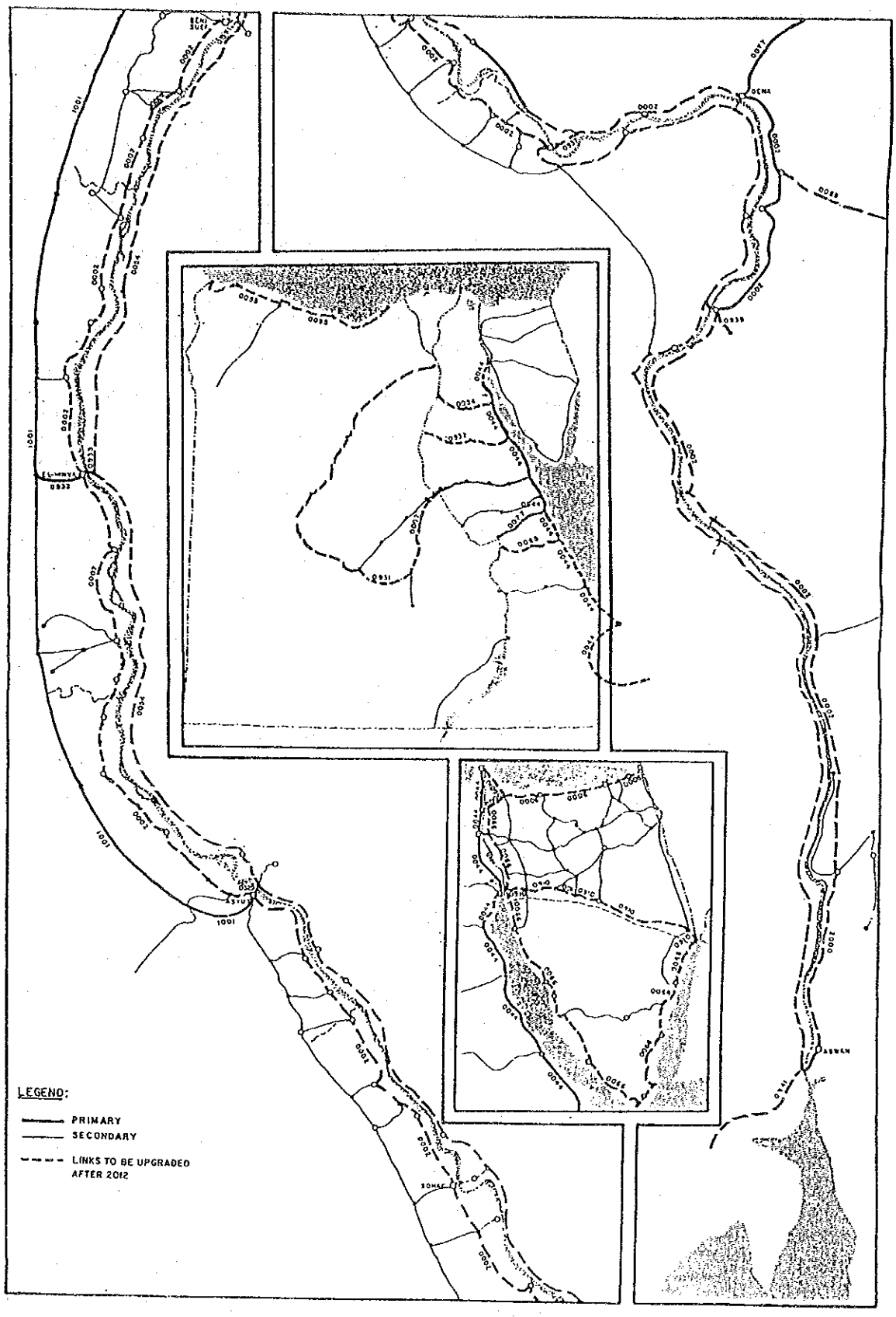


Fig. 14-5-8 Links in the Primary Network to be Upgraded after 2012. b) Upper Egypt

like that prevailing in 1992.

14.5.4 Upgrading the Network within the Proposed Network Hierarchy

Reviewing the lists of projects till the year up till 2012, and comparing the target 2012 network presented in Fig. 14-5-6 with the network hierarchy proposed under section 14.2, it is clear that most of the links included in the primary network will no have enough capacity to cope with the increase in traffic till the year 2012. The upgrading of the links belonging to the primary inter city highway network have to be carried out according to the design and safety standards of this category. Upgrading to divided multi-lane routes having very high traffic volumes will be tested for their feasibility to a higher level of service of freeway in Chapter 15. However, there are some links belonging to the primary network and which still have spare capacity to cope with the increase of traffic till the target master planning year 2012. Fig. 14-5-8 shows these links. These links have to be rebuilt to the primary network design and safety standards after the year 2012.

14.6 Financial Capability and Highway Project Cost Estimate

14.6.1 Financial Capability

The expenditure in the highway sector in FY 1992/93 is summarized as in Table 14-6-1. The development expenditure was 192 M.LE including those in Ministry of Construction.

Table 14-6-1 Highway Sector Expenditure in FY 1992/93

Description	(M.LE)
1. Development Expenditure	192
MOC	60
RBA	132
2. Maintenance Expenditure	160
Public Fund	121
Structural Maint.	109
Routine Maint.	12
Fuel Tax	22
Toll	17
3. Total	352

The highway development expenditure excluding those for highway maintenance in Third Five Year Plan is summarized in Table 14-6-2. The simple annual average can be calculated at 117 M.LE by dividing the total of 5 years expenditure by 5 years, which is almost 60% of 1992/93 records.

Table 14-6-2 Highway Development Expenditure in Third Five Year Plan

Description	M.LE
1. RBA Development Expenditure	445
2. MOC Road Expenditure	139 (Estimate)
3. Total	584
Annual Average	117

Two alternative estimate of financial capability of highway development expenditure for 20 years were calculated based on future GDP growth rate. Table 14-6-3 and Fig. 14-6-1 show the estimate results of alternatives by phases. Alternative-1 is estimated based on the FY 1992/93 records and alternative-2 is based on the annual expenditure in the Third Five Year Plan. The total of two alternatives are 7,458.3 M.LE and 3,898.5 M.LE. The basic inter city highway network development will be planned within these two figures.

Table 14-6-3 Financial Capability of Highway Development Expenditure

Unit:M.LE

Phase	Period	Alt-1	Alt-2
I	1993-1997	1,117.3	584.0
II	1998-2002	1,493.0	780.4
III	2003-2007	2,045.5	1,069.2
	2008-2012	2,802.5	1,464.9
	subtotal	4,848.0	2,534.1
Total		7,458.3	3,898.5

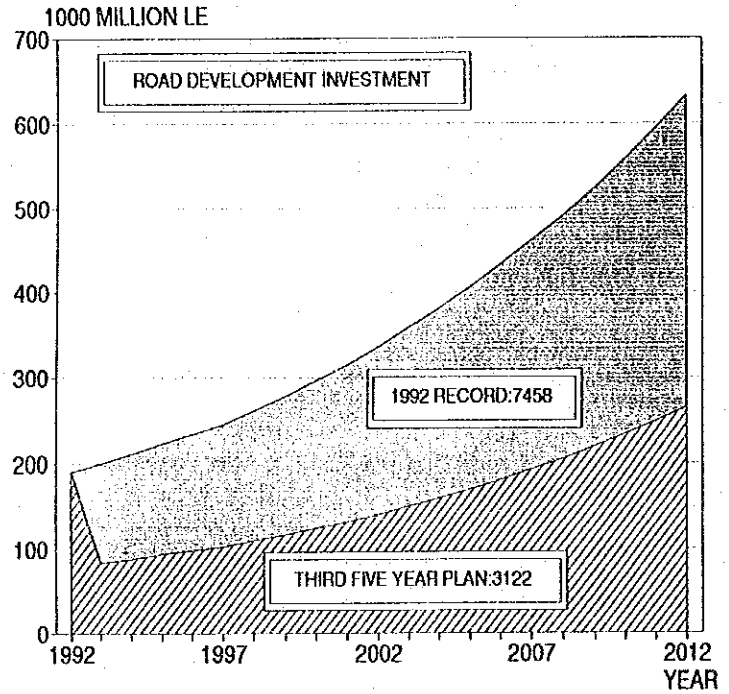


Fig. 14-6-1 Financial Capability of Highway Development Expenditure

14.6.2 Highway Project Cost Estimate

(1) Estimate Procedure

Costs of RBA highway projects have been estimated based on the current contract records per meter with public construction companies by type of works. While the estimate based on labor cost, material cost, equipment cost and their productivities gives another costs in terms of financial cost and economic cost, where any transfer costs are excluded and all the prices are re-evaluated as the border price. When comparing these estimate with the traditional estimate, the big discrepancies, which could not be explained by the difference of unit prices of labor or materials, were found and when depreciation costs of equipment are excluded from the

procedure, the financial costs reaches to the same level as the traditional costs.

In the Third Five Year Plan, the budget of 75 M.LE to purchase equipment and vehicles are allocated to this construction companies. Therefore the financial cost estimate follows the traditional manner and the economic cost estimate follows the international bidding procedure with equipment depreciation costs.

However, the cost of each project included in RBA 3rd Five Year Plan has been assumed as the anticipated costs estimated by RBA, while the costs of the projects of Ministry of Reconstruction have been assumed as those approved in the Third Five Year Plan. The costs anticipated by RBA are little higher than those approved by Ministry of Planning. The total costs of the plan amounts to 877 M.LE, which is little higher than that budgeted in the Third 5-year Plan.

(2) Unit Cost per Meter

Table 14-6-4 shows the resulted unit cost per meter for each work type. Economic costs are about 1.4 times higher than financial costs.

Table 14-6-4 Cost per Meter by Works

	Financial Cost (LE/m)			Economic Cost (LE/m)		
From	to 2 Lane	4 Lane	6 Lane	2 Lane	4 Lane	6 Lane
-	244.53	539.26	724.51	353.13	767.12	1034.64
2- 6.0m	96.33	391.06	576.31	139.11	553.10	820.62
2- 6.5m	83.98	378.71	563.96	121.28	535.26	802.79
2- 7.0m	71.63	366.36	551.61	103.44	517.43	784.95
2- 7.5m	0.00	294.73	539.26	0.00	413.98	767.12
4 Lane	0.00	0.00	303.81	0.00	0.00	438.74

(3) Cost of Highway Projects

Estimated highway project costs for totally 95 projects are listed in Table 14-6-5. The total financial cost is 3,320.1 M.LE and 4,376.7 M.LE in economic cost.

Table 14-6-5 Estimated Highway Project Costs

Project Code	Distance (Km)	Cost		Project Code	Distance (Km)	Cost	
		Financial (M.LE)	Economic (M.LE)			Financial (M.LE)	Economic (M.LE)
1001	104.0	54.4	78.5	2021	10.5	1.5	2.2
1002	32.0	16.7	24.2	2022	26.0	4.3	6.2
1004	18.0	16.7	23.8	2023	17.6	2.9	4.2
1005	43.0	7.1	10.3	2024	16.0	2.7	3.8
1006	4.0	2.0	2.8	2041	20.0	8.4	12.2
1007	16.5	8.4	11.8	2112	78.9	40.0	56.2
1008	48.0	24.3	34.2	2113	86.0	36.2	52.2
1009	14.0	2.3	3.4	2114	60.0	25.2	36.5
1010	14.0	9.1	12.9	2115	40.0	6.6	9.6
1011	35.0	17.7	24.9	2117	72.0	48.4	68.5
1012	38.0	19.3	27.1	2118	61.0	30.9	43.4
1013	25.0	16.8	23.8	2119	61.0	30.9	43.4
1014	9.0	1.5	2.2	2120	286.0	19.5	68.4
1015	33.0	5.5	7.9	2121	321.0	55.5	195.0
1101	44.0	30.0	64.4	2122	250.0	105.2	151.9
1102	56.5	42.0	41.1	2123	235.0	98.9	142.8
1103	42.0	10.0	8.8	2133	6.0	130.0	130.4
1104	100.0	15.0	23.9	2134	2.0	43.3	43.5
1105	472.0	250.0	286.7	2135	1.0	0.6	0.0
1106	240.0	100.0	145.8	2136	1.0	0.5	0.7
1107	40.0	9.0	24.3	3005	51.0	36.9	52.2
1108	75.0	70.0	45.6	3008	6.0	0.9	1.3
1109	176.0	32.0	42.1	3010	77.0	160.7	173.5
1110	45.0	23.0	27.3	3011	23.5	15.8	22.4
1111	40.0	20.0	24.3	3012	43.0	7.1	10.3
1124	2.5	35.0	54.4	3015	5.0	3.4	4.8
1125	3.0	30.0	64.5	3016	39.0	19.8	27.8
1126	1.0	10.0	20.8	3018	23.0	15.5	21.9
1127	2.5	10.0	79.8	3019	24.0	4.0	5.7
1128	4.0	17.0	88.4	3024	16.0	10.8	15.2
1129	2.5	17.0	53.8	3025	61.0	31.9	46.0
1130	3.0	22.0	64.5	3026	389.0	197.2	277.0
1131	2.0	25.0	1.2	3027	44.0	22.3	31.3
1132	75.0	35.0	45.6	3028	8.0	5.0	7.1
2003	205.0	107.1	154.7	3029	399.0	202.3	284.2
2004	56.5	29.5	42.6	3030	7.0	3.5	5.0
2006	46.0	29.5	41.6	3031	165.0	83.7	117.5
2008	13.0	2.2	3.1	3032	11.0	6.9	9.8
2009	14.0	9.4	13.3	3033	37.0	6.1	8.9
2010	17.0	9.0	12.6	3034	22.0	3.6	5.3
2011	96.5	40.9	57.6	3035	39.0	6.5	9.3
2013	30.0	15.2	21.4	3036	11.0	1.8	2.6
2014	28.5	18.2	25.8	3037	30.0	5.0	7.2
2015	52.0	31.0	43.7	3038	26.0	20.8	29.5
2016	18.0	9.1	12.8	3039	272.0	103.0	148.7
2017	4.0	2.0	2.8	3040	6.5	37.5	39.8
2018	23.0	3.8	5.5				
2019	14.0	2.3	3.4	Total	5985.0	3020.1	4376.7
2020	22.0	3.6	5.3				

14.7 Project Priorities and Scheduling

14.7.1 Project Priority

The economic priorities of individual project components were calculated by Feasibility Study type and Master Plan type evaluations. Feasibility Study type is to evaluate the economic efficiency of each project adding the target project to Do-nothing network and the benefit of the project is defined as VOC saving from Do-nothing case. While Master Plan type is to evaluate extracting the target project from Master Plan network and the benefit of the project is defined as VOC increase from Master Plan case. A project which can be executed independently will give high priority in F/S type evaluation, while a project which is critical in a Master Plan such as a bridge project will give high priority in M/P type evaluation.

All the 95 project components are classified into three categories of phase I, II and III from the view point of optimum highway development strategy. These three groups were evaluated within the groups they belong to, and annual benefit derived from VOC saving or increase was calculated based on Do-nothing case and Master Plan case in the end years of each phase, i.e. 1997, 2002 and 2012. The costs were converted into a single year investment by the formula applied in the optimum V/C calculation.

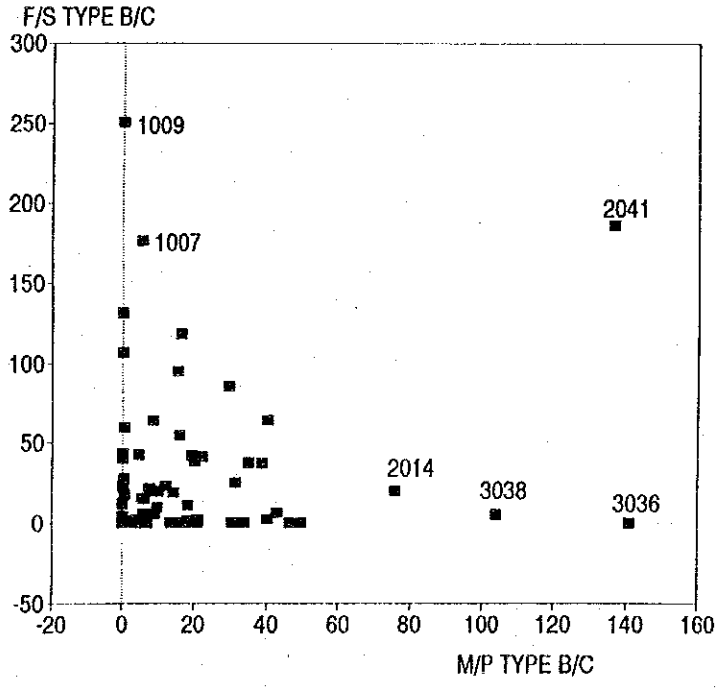


Fig. 14-7-1 B/C of Individual Projects

Fig. 14-7-1 shows the of F/S type and M/P type B/C of each project. The project which shows the highest B/C both in F/S and M/P type evaluations is Dar El Salam - Naga Hamadi 2 lane road construction project (2041).

The project which shows the highest benefit scale is Cairo - Asyut Desert road widening project from 2 lane to divided 4 lane road after the construction of 2 lane road.

14.7.2 Project Scheduling

A yearly scheduling time table for the execution of the individual projects has been worked out. However, RBA has requested from the study team not to change the schedule of the third five year plan approved projects. Following are some clarifications for the basis of the scheduling:

- The first five years 1992/1997 includes only the execution of the five year plan projects of RBA of Ministry of Transport as well as the 1992/1997 approved projects of Ministry of Reconstruction. Most of the 1992/1997 scheduled projects are of the land use development and strategic type (LDA) and not to maintain the 1992 level of services (MLS). As has been shown during the operational evaluation of the optimum proposed plan that the level of service will drop more than anticipated due to postponing of most of the traffic responsive projects to the period 1997/2002.

- Starting from 1997/98, an increase in the yearly budget of 6.5% (the assumed economic growth rate) till the year 2012 has been assumed. The total cost of the rest of the projects which amounts to 2143.1 M.LE have then to be scheduled for the years 1997/98 till 2012 and has been distributed on yearly bases according to this increasing rate. Taking the priority ranking into consideration, yearly scheduling and budgeting have been worked out till the year 2012. The total budget for the fourth 5-year plan amounted to 607.4 M.LE. The total budget for the last 10 years has been assumed to be 1,535.7 M.LE.

- Governmental proposed projects, which were not accepted in the Third 5-year Plan have been scheduled according to their priority ranking in the Fourth 5-year Plan and thereafter.

Table 14-7-1 Basic Highway Project Financial Cost by Phase

Unit:M.LE

PHASE	PERIOD	LDA	MLS	TOTAL
I	1993-1997	877.0	0.0	877.0
II	1998-2002	96.1	511.3	607.4
III	2003-2012	500.6	1,035.1	1,535.7
TOTAL		1,473.7	1,546.4	3,020.1

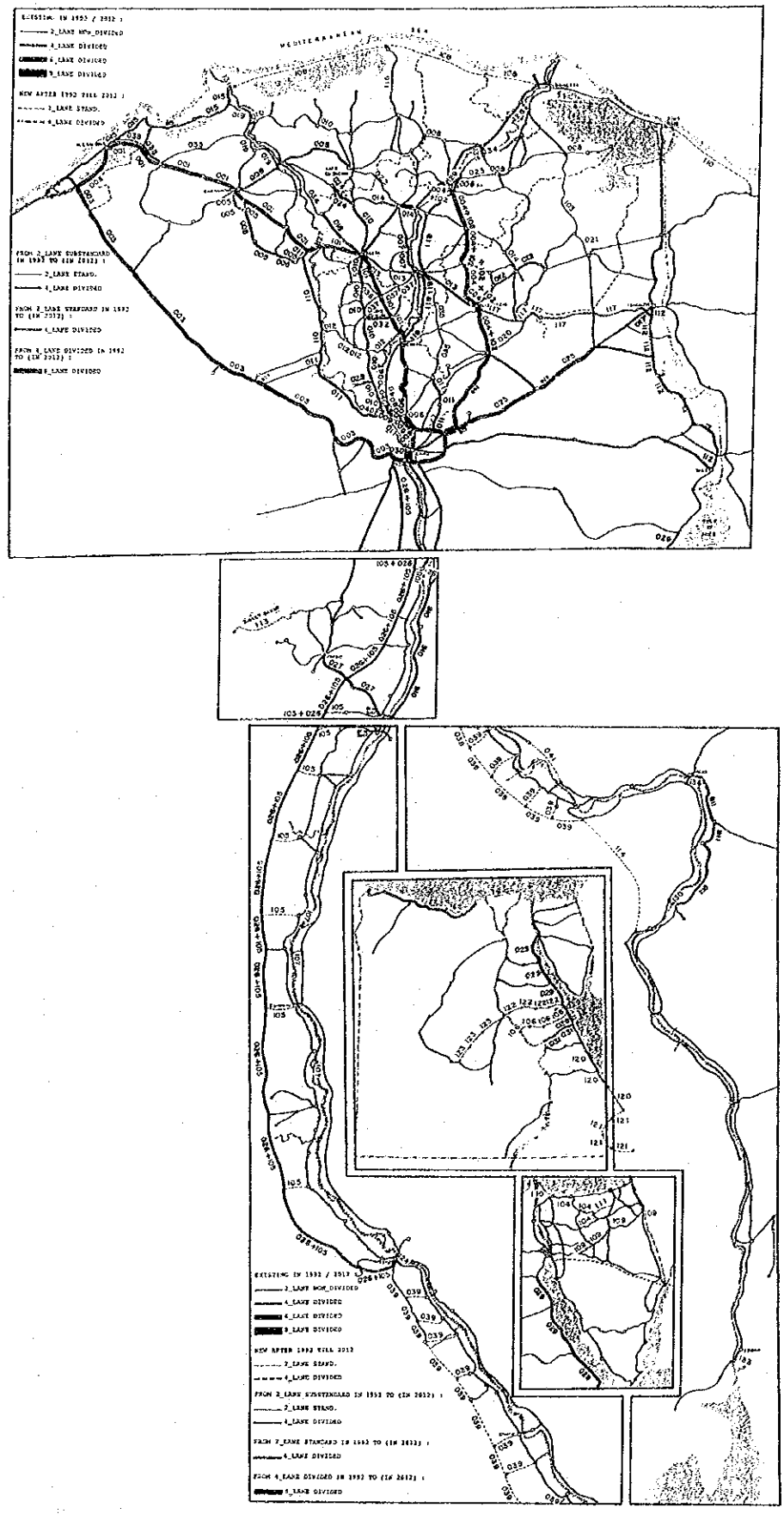


Fig. 14-7-3 Basic Network Projects

Implementation Schedule of Basic Highway Network Projects

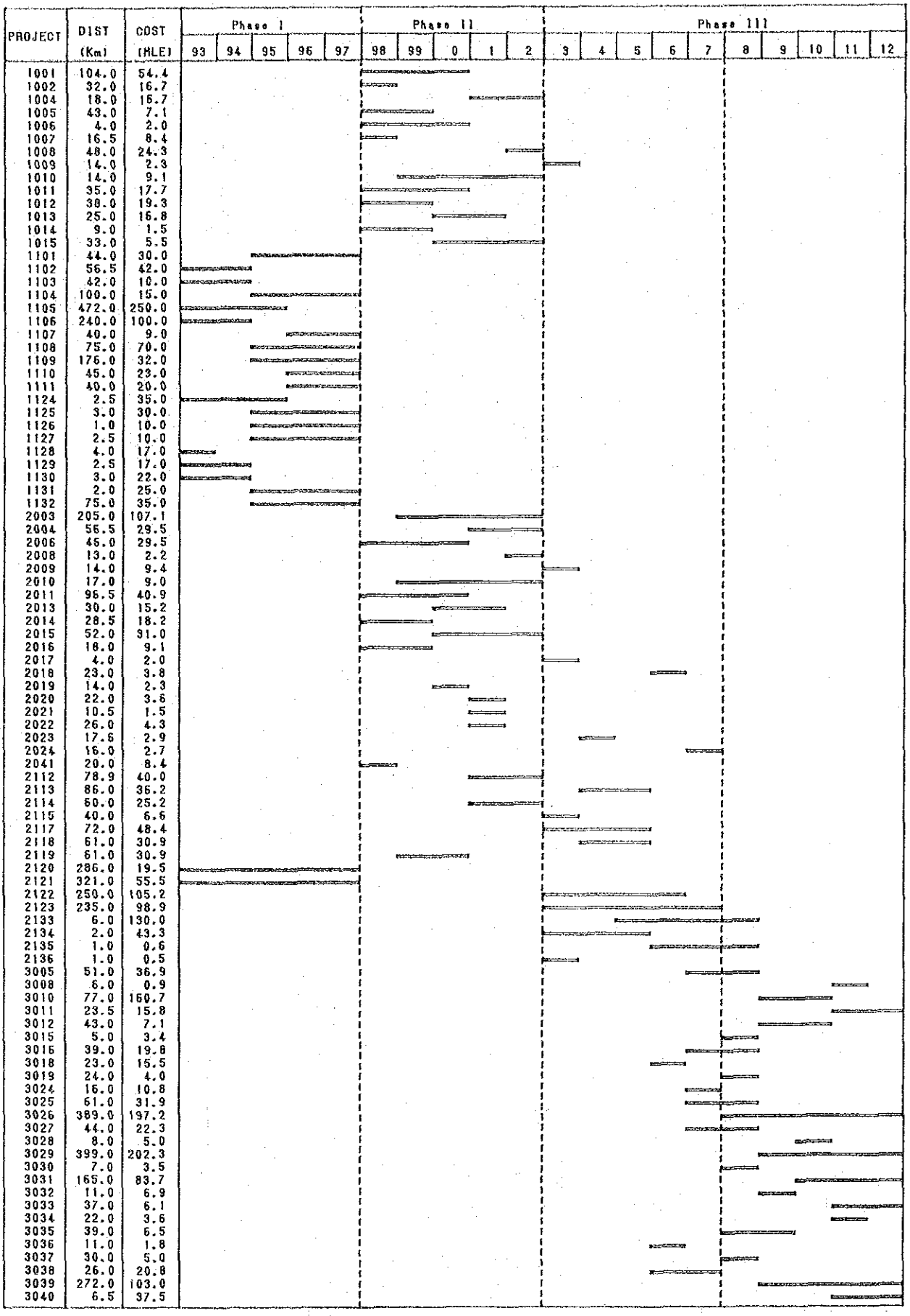


Fig. 14-7-2 Project Implementation Schedule

Fig. 14-7-2 includes the proposed scheduling. Table 14-7-1 shows the required budget by phase and by project classification. Fig. 14-7-4 shows annual investment schedule.

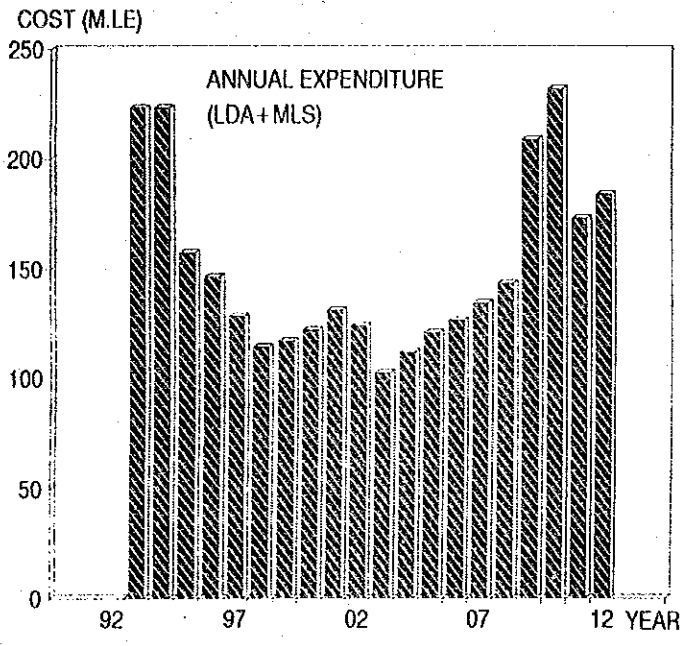


Fig. 14-7-4 Annual Investment Schedule

14.8 Structure Improvements

14.8.1 Nile Bridges

Currently, there exists 17 bridges and 4 barrages over the Nile and following 8 are under construction or planned to be constructed during this five year plan period.

(1) Rashid (Coastal Road)
(2) Faraksor
(3) Shirbin
(4) Talkha (Mansoura)
(5) Mit Ghamr (Zifta)
(6) Asyut
(7) Luxor
(8) Aswan

If the Basic Network is developed as proposed in this Study, furthermore following 4 brides will be constructed in addition to above. By this, inter city traffic will be well served in the future.

(9) Mutbis
(10) Kafr El Zaiyat (Widening of Cairo-Alexandria Agriculture Road)
(11) Gerza
(12) Qena

Apart from the highway network for inter city traffic, locally needed bridges are studied here. Theoretically, they are not in the category of Master Plan projects. However, a bridge construction over the Nile is a big project and its cost is significant in the budget of RBA. The schedule of the Master Plan will be affected by how many and when local bridges are constructed. In this connection, additional bridges to serve the local traffic demand are to be planned.

RBA has an intention to construct bridges over the Nile at a pace of one bridge a year. If so, 20 new bridges can be expected in coming 20 years. That means 5 to 10 bridges are reasonable in number for planning of local bridges.

On the geographical map, were plotted all the bridges; existing, under construction, under planning and in the Basic Network. Based on this map, candidate sites for local bridges were identified according to the following principles:

A. Maximum interval of adjacent bridges shall be 50 Kms, so to enable to cross the Nile by traveling 25 Km along the river in maximum.

B. A bridge shall be constructed where a east-west lateral road is connected without bridge crossing.

As the result of analysis, seven candidate sites were identified at;

(13) Kom Ombo
(14) Qift
(15) Girga
(16) Tima
(17) Mallawi
(18) El Fashn
(19) Ashmun

In order to evaluate the relative importance of these sites, the following indicators were developed:

1. Traffic Demand
1-1 Inter city Traffic: estimated by traffic assignment.
1-2 Local Traffic: Traffic data are not available, then substituted by population. The product of population in the west bank and in the east bank of the Nile may stand for the magnitude of local traffic demand.
2. Existence of Lateral Road Connection
3. Existence of Tourist Spot on the Opposite Side

The results are shown in Table 14-8-1, and Table14-8-2 is expressed in priority ranking. Girga Bridge ranked at A is to be scheduled in the period of 1998-2002 and other bridges are after 2002.

Table 14-8-1 Situation of Additionally Proposed Bridges

Candidate Site	Existing Bridge			Population (1,000) 1992			Population (1,000) 2012			Lateral Road Con.	Tourist Site at Opposite	Inter City Traffic
	Upper	Lower	Km	A East	B West	AxB	A East	B West	AxB			(pcu/d)
Kom Ombo	Aswan	Idfu	106	413	0	0	905	0	0	-	-	-
Qift	Esna	Qena	114	330	100	33	364	110	40	0	0	1,575
Girga	Nag Hamadi	Akimin	76	505	1,344	679	1,134	2,634	2,987	-	0	13,463
Tima	Akimin	Ashyt	103	416	1,490	620	776	3,103	2,408	-	0	2,963
Mallawi	Ashyt	Minya	123	414	2,044	846	705	3,444	2,428	-	0	338
El Fashn	Minya	Beni Suef	77	0	1,322	0	0	2,200	0	-	0	9,038
Ashmun	Qanatir	Tamalai	116	892	0	0	1,562	0	0	-	-	3,900

Table 14-8-2 Evaluation of Additionally Proposed Bridges

Candidate Site	Traffic Demand		Lateral Road Connection	Tourism Site on Opposite	Comprehensive Evaluation
	Local (1)	Inter City (2)			
1 Kom Ombo	-	-	-	-	C
2 Qift	C	C	A	C	B
3 Girga	A	A	-	C	A
4 Tima	B	B	-	C	B
5 Mallawi	B	C	-	B	B
6 El Fashn	C	A	-	C	B
7 Ashmun	C	C	-	-	C

(1) Population (P1xP2) A:2,500 Million-
B:2,000 - 2,500 Million
C: 0 - 2,000 Million

(2) Traffic A:10,000 pcu/d -
B: 5,000 - 10,000 pcu/d
C: 0 - 5,000 pcu/d

Total cost of these seven bridges are estimated at 227.5 M.LE, assuming 32.5 M.LE per one bridge.

Table 14-8-3 Nile Bridge Projects

Bridge Location	Status	Phase	Cost (M.LE) Financial	Economic	
Rosetta Branch					
1 Rashid	B	1	32.5	32.6	under planning
2 Mutbis	B	2	32.5	32.6	
3 Kafr El Zaiyat	B	2	10.0	10.0	additional 3 lanes
4 Ashmun	A	3	32.5	32.6	
Damietta Branch					
5 Faraskour	B	1	26.0	26.1	under construction
6 Shirbin	B	1	32.5	32.6	under planning
7 Talkha	B	1	20.0	20.0	under construction
8 Mit Ghamr(Zifta)	B	1	32.5	32.6	under planning
Nile Valley					
9 Gerza	B	2	32.5	32.6	
10 Girga	A	2	32.5	32.6	
11 El Fashun	A	3	32.5	32.6	
12 Mallawi	A	3	32.5	32.6	
13 Asyut	B	1	32.5	32.6	under planning
14 Tima	A	3	32.5	32.6	
15 Qena	B	3	32.5	32.6	
16 Qift	A	3	32.5	32.6	
17 Luxor	B	1	22.0	22.1	under construction
18 Kom Ombo	A	3	32.5	32.6	
19 Aswan	B	1	32.5	32.6	under planning:Cable Stay Type
Total			565.5	566.9	

Status: A:Additional
B:Basic Network Project
Phase: 1:1993-1997
2:1998-2002
3:2003-2012

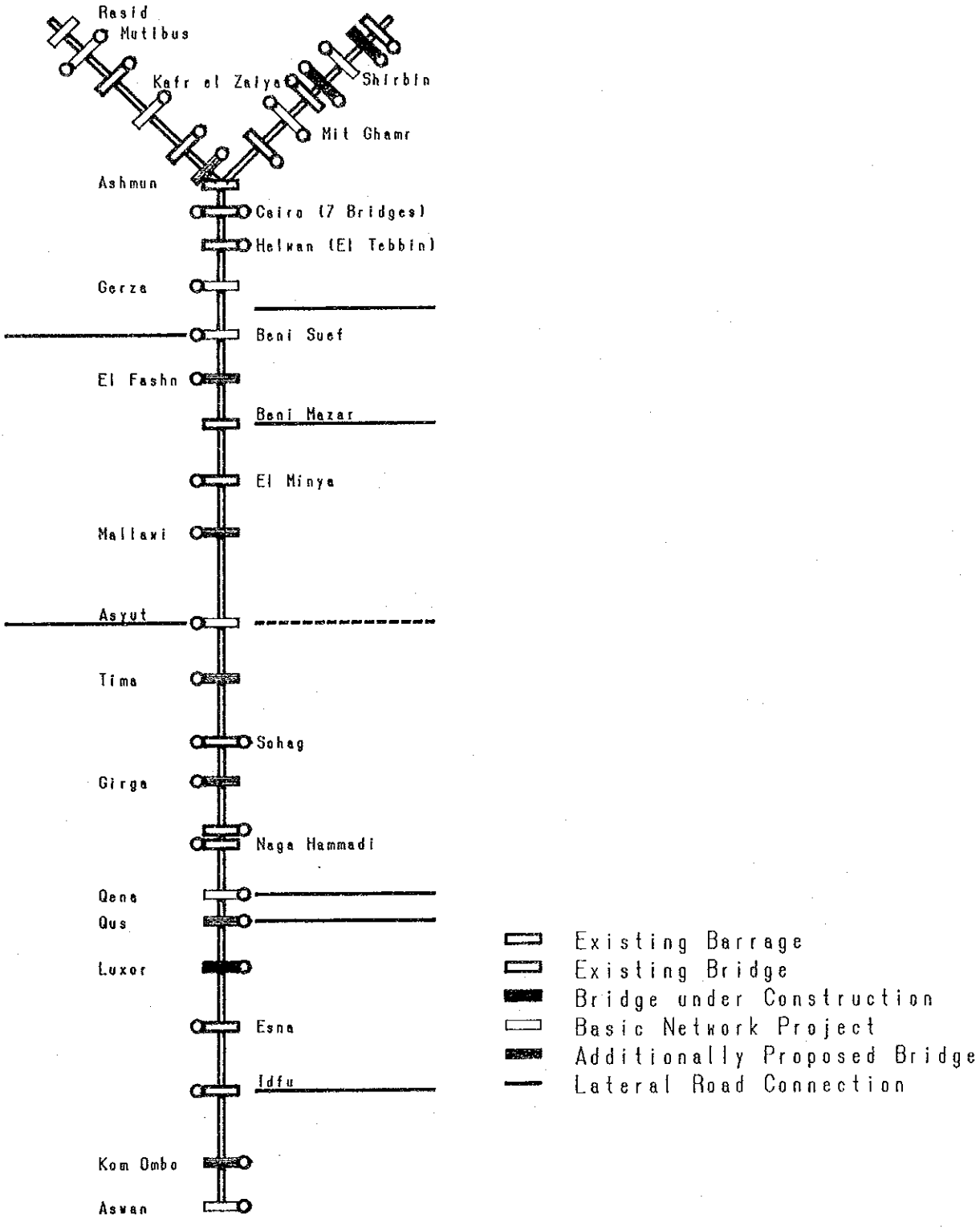


Fig. 14-8-1 Nile Bridge Location

14.8.2 Railway Crossings

There are 54 level railway crossings on the inter city highway network, and at Aiyat railway cross (project code 1126) on the upper Egypt Highway and Cairo - Aswan Line is planned to be grade separated in the Third Five Year Plan. These level crossings are checked against their necessity to be graded from the view point of economic efficiency.

Total VOC saving can be calculated by the total waiting time and train frequency, and the total waiting time can be estimated by the traffic demand and average waiting time for one train. If total VOC saving exceeds the annual construction cost of multi-graded railway cross, the construction can be justified from economic point of view. This relationship can be shown by the following formula;

Annual delayed Traffic Volume x Closing Time /2 x C > i x F
where, C : time related vehicle operating cost
i : interest
F : annual cost

Fig. 14-8-2 shows the present situation of these railway crossings by daily traffic volume (PCU/Day) and train frequency. Average waiting time of 3 min. for one train, 12% of interest, 25 years of project life, 5.889 LE/hr/PCU of average time related VOC for all types of vehicles, and 8% of peak hour factor are assumed in this figure.

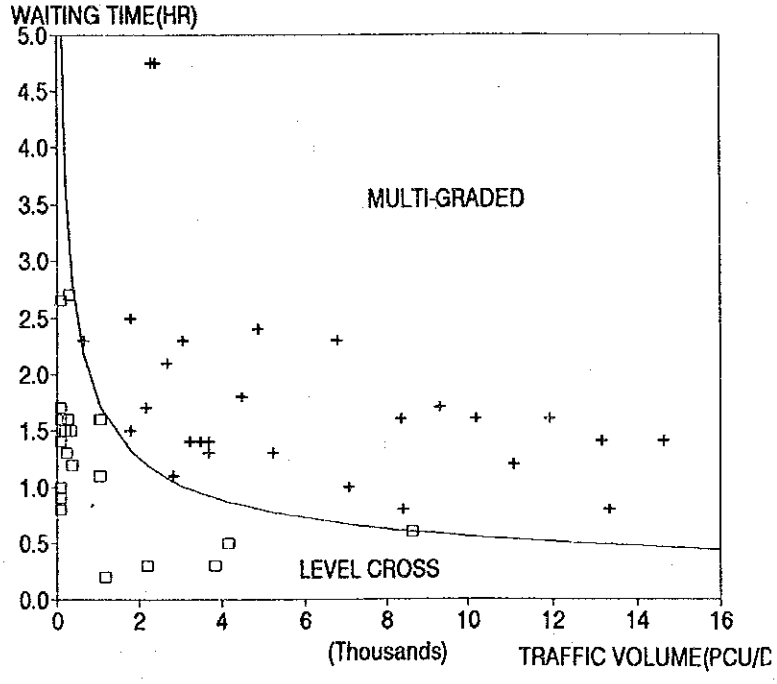


Fig. 14-8-2 Train Frequency and Traffic Demand at Railway Crossings

The figure shows that necessity of multi-grade crossing is more sensitive to train frequency than the traffic demand on highways. The most urgent railway crossing is on Qaliub - Shibin el Qanatir on Cairo - Alexandria Line, where daily 200 trains are operating. Totally 40 railway crossings out of 54 have to multi-graded at present, and in 2012, if train frequency will not change, this number will change only to 41. Total financial cost of these 40 railway crossings is estimated at 840.0 M.LE, of which 19 level crossings are included in the Basic Master Plan Network.

14.9 Economic Evaluation of Basic Highway Master Plan

14.9.1 Evaluation of Basic Highway Master Plan

Fig. 14-9-1 shows the process to calculate evaluation indices of a highway project. VOC saving comparing to Do-nothing case for each of 20 years were calculated based on the project scheduling. Table 14-9-1 shows the cash flow of benefit and economic cost from 1993 to 2012. After the long term target year of 2012, the same amount of VOC saving as in the year 2012 was assumed for 5 years until 2017.

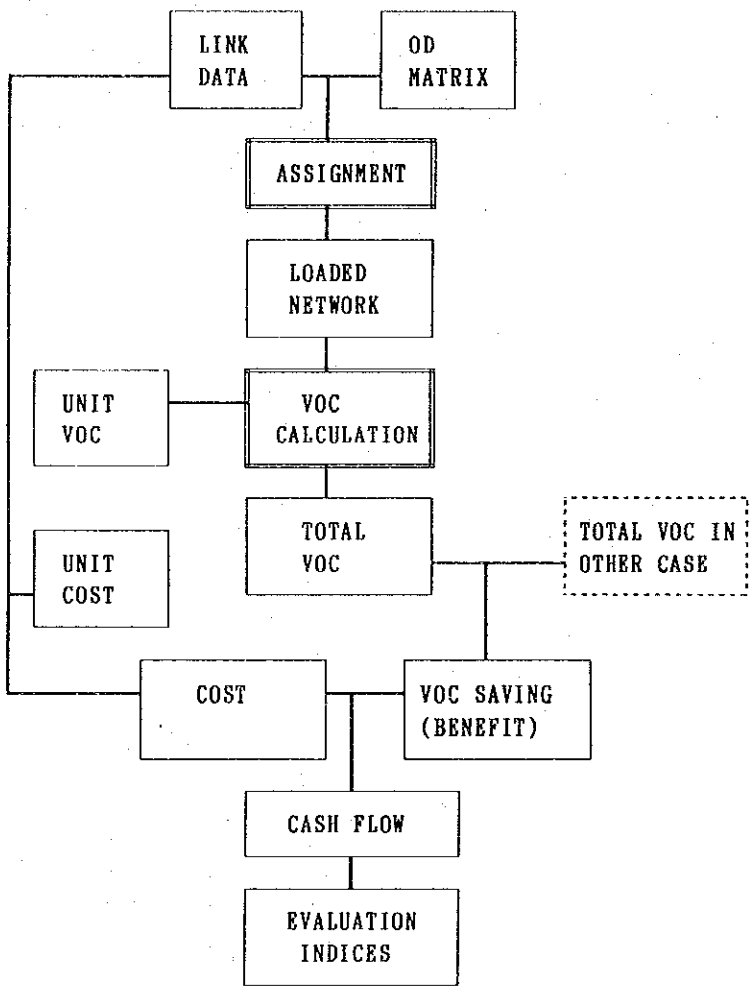


Fig. 14-9-1 Flow Chart of Evaluation Indices Calculation

The resulted IRR of 78.8%, NPV of 21,680.1 M.LE with discount rate of 12% p.a., and B/C of 13.1 shows high economic return of the basic highway master plan, because of relatively low investment cost of widening and extremely uneconomical condition of Do-nothing case.

Table 14-9-1 Economic Cash Flow of Basic Highway Master plan

Unit:M.LE

	YEAR	WITHOUT DISCOUNT			WITH DISCOUNT (12%)		
		COST	BENEFIT	B-C	COST	BENEFIT	B-C
	1992		0.0	0.0	0.0	0.0	0.0
1	1993	385.7	0.9	-384.8	344.4	0.8	-343.6
2	1994	334.4	54.6	-279.9	266.6	43.5	-223.1
3	1995	253.1	491.4	238.3	180.2	349.8	169.6
4	1996	262.8	571.2	308.4	167.0	363.0	196.0
5	1997	234.7	1,345.7	1,111.0	133.2	763.6	630.4
6	1998	162.4	1,873.2	1,710.8	82.3	949.0	866.8
7	1999	166.2	1,907.1	1,740.9	75.2	862.7	787.5
8	2000	173.5	3,588.4	3,414.9	70.1	1,449.3	1,379.2
9	2001	187.4	3,686.0	3,498.6	67.6	1,329.2	1,261.6
10	2002	176.2	5,278.8	5,102.6	56.7	1,699.6	1,642.9
11	2003	140.3	5,196.8	5,056.5	40.3	1,494.0	1,453.6
12	2004	153.5	5,879.3	5,725.8	39.4	1,509.1	1,469.7
13	2005	161.0	6,314.1	6,153.1	36.9	1,447.0	1,410.1
14	2006	159.2	6,392.9	6,233.7	32.6	1,308.1	1,275.5
15	2007	173.7	6,726.7	6,553.0	31.7	1,228.9	1,197.2
16	2008	191.1	7,227.9	7,036.8	31.2	1,179.0	1,147.8
17	2009	272.1	7,315.2	7,043.1	39.6	1,065.4	1,025.8
18	2010	298.0	7,700.9	7,402.9	38.8	1,001.4	962.7
19	2011	242.4	7,765.5	7,523.1	28.1	901.6	873.5
20	2012	248.9	9,474.4	9,225.5	25.8	982.2	956.4
21	2013		9,474.4	9,474.4	0.0	876.9	876.9
22	2014		9,474.4	9,474.4	0.0	783.0	783.0
23	2015		9,474.4	9,474.4	0.0	699.1	699.1
24	2016		9,474.4	9,474.4	0.0	624.2	624.2
25	2017		9,474.4	9,474.4	0.0	557.3	557.3
	TOTAL	4,376.6	136,162.6	131,786.0	1,787.6	23,467.7	21,680.1
						NPV=	21,680.1
						B/C=	13.1
						IRR=	78.8

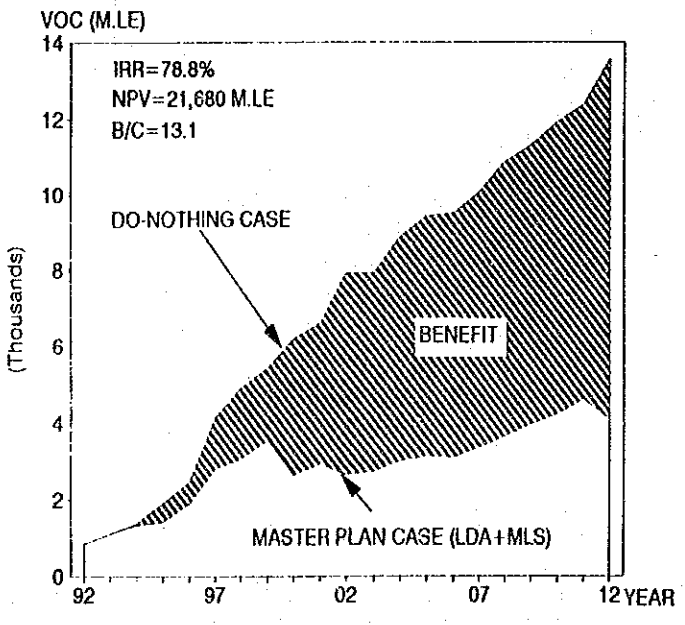


Fig. 14-9-2 Evolution of VOC in Do-nothing Case and Basic Master Plan Case

14.9.2 Sensitivity Analysis to GDP Growth Rate

VOC in 2012 in both Do-Nothing and Master Plan cases were calculated assigning 2012 OD calculated by low GDP growth rate case (5.1% p.a.) to the highway networks in 2012. The vehicle demand in the GDP 5.1% case is estimated at 640,422 veh/day or 0.86 times that in GDP 6.5% (1998 - 2012) case. The calculated VOCs are presented in Table 14-9-2. VOC reduction in 2012 in Do-Nothing case is bigger of 12% than that in the master plan case (9%). The resulted reduction of benefit is 14% from that in GDP 6.5% case.

Table 14-9-2 VOC in 2012 under Different GDP Growth Rate

Case in 2012	VOC(M.LE/year)		(2)/(1)
	(1) 6.5%	(2) 5.1%	
Do-Nothing	13,574.0	11,888.1	0.88
Master Plan	4,099.6	3,724.2	0.91
Benefit	9,474.4	8,163.9	0.86

The economic cash flow based on this VOC reduction rate was calculated in the same manner as stated in the previous section, and gave the economic returns as shown in Table 14-9-3, which indicates almost same reduction rates from the GDP 6.5% case as that of GDP itself and no serious reduction of economic returns is anticipated.

Table 14-9-3 Economic Indices under Different GDP Cases

Indices	GDP Cases		
	(1) 6.5%	(2) 5.1%	(2)/(1)
IRR(%)	78.8	71.9	0.91
NPV(M.LE)	21,680.1	18,394.6	0.85
B/C	13.1	11.2	0.85

14.9.3 Impact to Natural Reserves

Fig. 14-9-3 shows the location of natural reserves proposed by Administration of Natural Reserves under Organization for Environmental Affairs of the cabinet. The swamp areas and lakes of Lake Manzara, Lake Bardawil at both east and west sides of Suez Canal, and Lake El Fayoum are designated as natural reserves, however master plan highway network except for Coastal road from Rashid to Damietta, which has been proposed by Governmental agency, will not invade these areas.

Cobba El Hasna, which is a marble hill located along Cairo - Alexandria desert road at the entrance to Cairo, have to be carefully reserved not to damage the area, when widening of this road to 6 lane will be executed. Also Rock Forest, where fossilized wood is produced, located close to Maadi - Ein Sokhna Road (route No. 103) is designated as one of natural reserves.

No serious impact is anticipated to these natural reserves by master plan highway network.

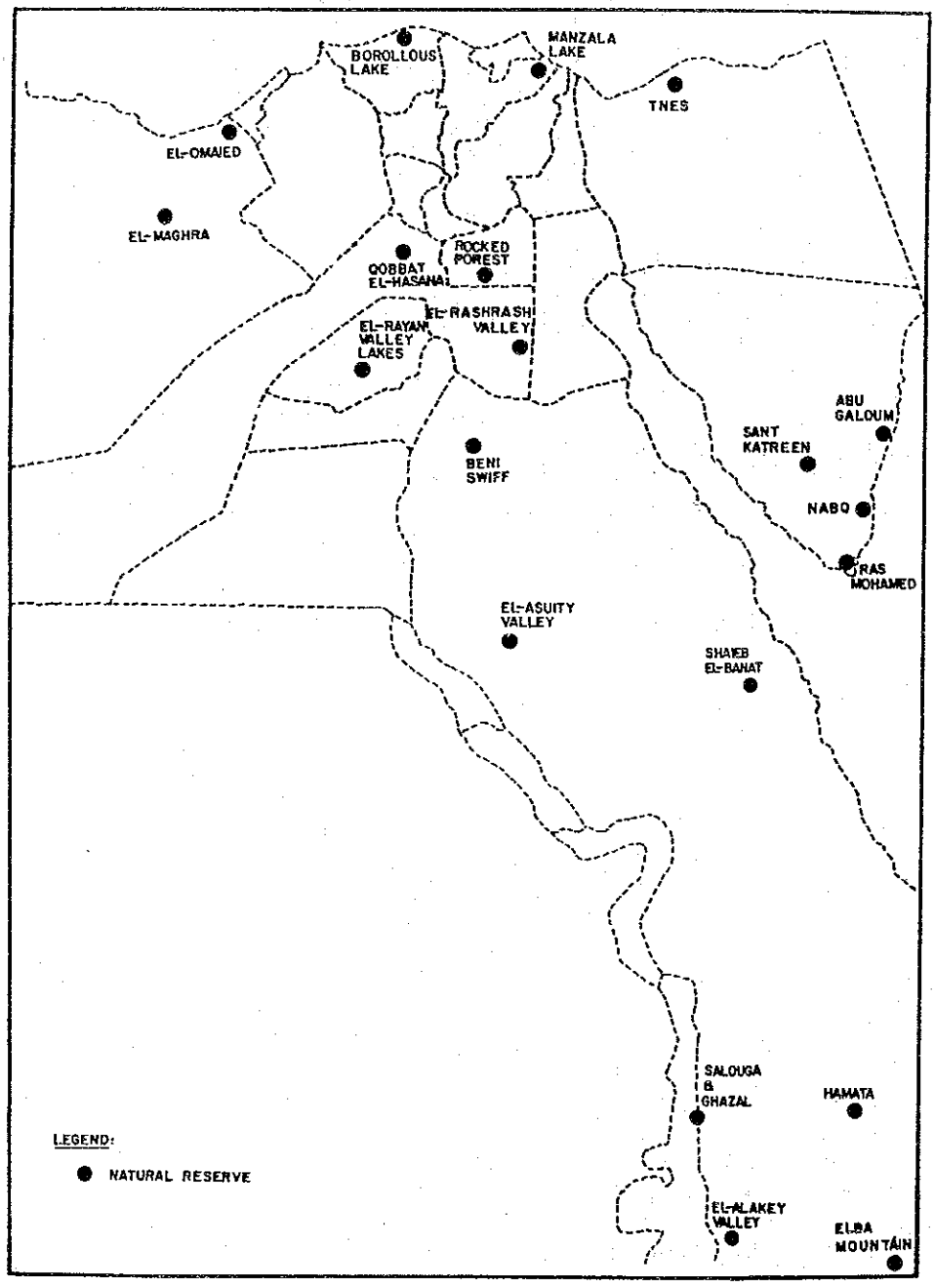


Fig. 14-9-3 Natural Reserves in Egypt

CHAPTER 15 FREEWAY MASTER PLAN

15.1 Alternative Freeway Network Development

15.1.1 Possible Freeway Location in Egypt

The basic master plan network will provide fundamental services to vehicle traffic even in future, however the service quality will remain unchanged as present. The inter city traffic frequently suffers from the disturbance of smooth flow by driving of slow and local vehicles on inter city highways, especially in agriculture area. This situation may reduce the traffic safety as well as driving speed and capacity. The basic master plan network will not provide counter-measures against this situation.

Full access controlled highway will provide one solution to this situation. Existing desert roads have few accesses and they are considered already access controlled highways, so that these enforced access controlled highways shall be planned in already populated and developed Delta area.

The freeways shall be planned to attract traffic demand. Fig. 15-1-1 shows the influenced population distribution within 15Km at both sides of radial axis, which are put at every 15 degree unti-clock wise with its center at Cairo from East. The highest population appears at 120 degree, which is the direction of Cairo - Tanta. The bent axis of Cairo - Tanta - Alexandria and Cairo - Tanta - Damietta show more influenced population.

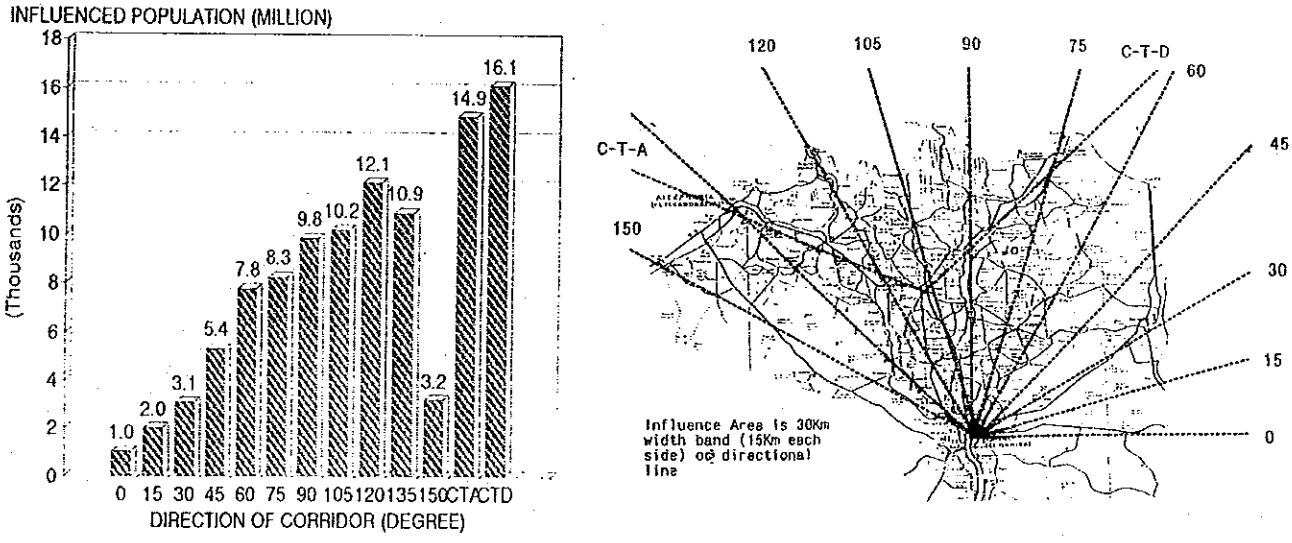
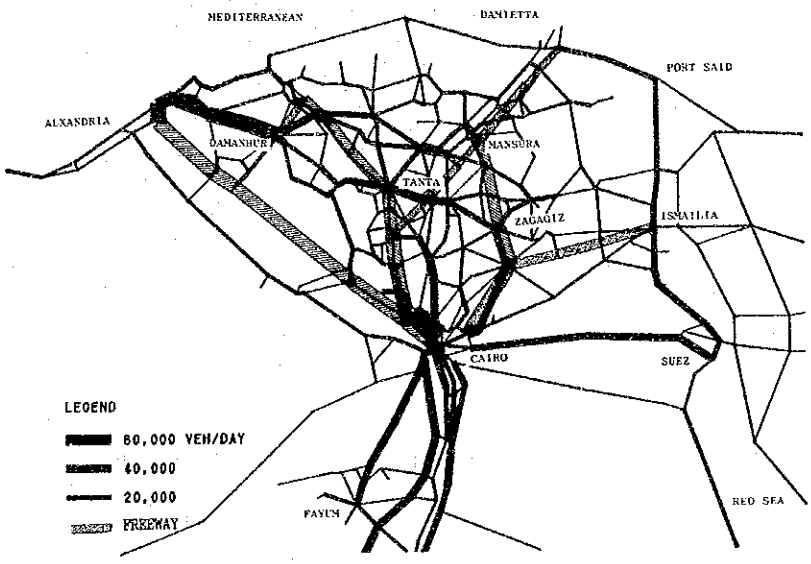


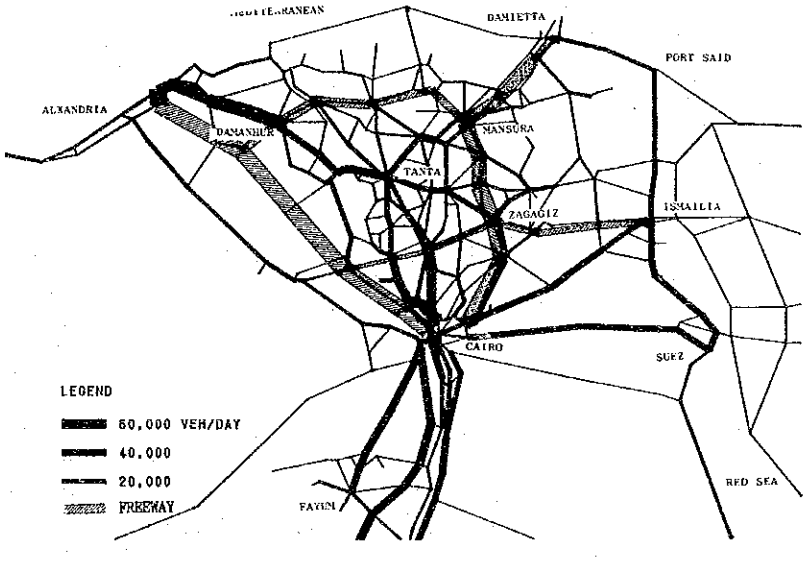
Fig. 15-1-1 Influenced Population Distribution

15.1.2 Alternative Freeway Networks

Three alternative freeway networks were planned taking population distribution, freeway intervals, and existing highway network. Fig. 15-1-2 shows these three freeway network alternatives. Traffic generated from Delta area can enter to freeways at interchanges allocated at every 30 - 50 Km and freeways are connected only at junctions. The characteristics of these alternatives are as follows;

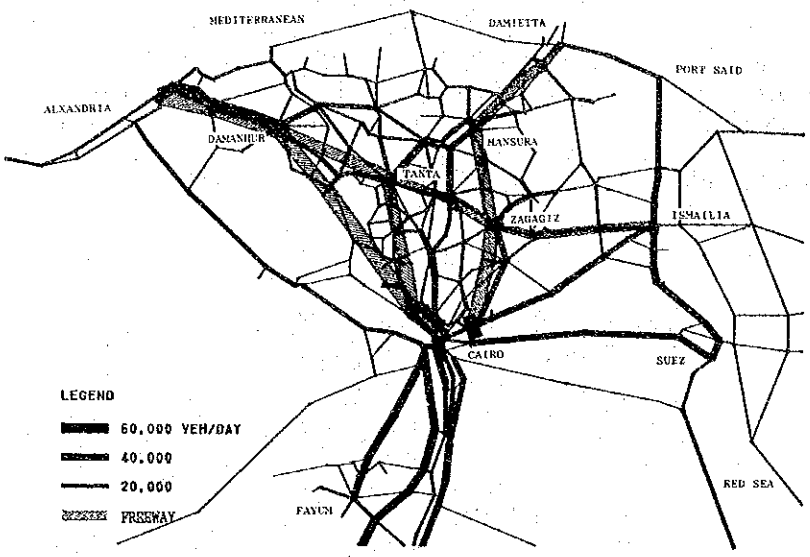


Alternative-1 Network and Traffic Flow



Alternative-2 Network and Traffic Flow

Fig. 15-1-2 Alternative Freeway Networks (1)



Alternative-3 Network and Traffic Flow

Fig. 15-1-2 Alternative Freeway Networks (2)

Alternative-1 aims at equal service to all Delta area with max. 50 Km access to the nearest freeway, so that any inter city traffic generated in Delta area can use freeways, following basically radial shape. Total freeway network length : 673.5 Km.

Alternative-2 aims to form double trunk line networks with existing trunk highways, so that inter city traffic can use either existing trunk highways or freeways, following radial and circular shape. The end of Zagazig - Ismailia section is connected to Sinai area across Suez Canal. Total freeway network length : 605.0 Km.

Alternative-3 is planned following high demand generating cities, and radial and transversal shape. The high traffic generating pints of Tanta and Damanhur are connected directly to Cairo, so that heavy traffic demand on Agriculture Road can be absorbed to freeways. Total freeway network length : 585.0 Km.

Operational evaluation of 3 alternatives in Table 15-1-1 shows the high percentages of entry traffic to the freeway network ranging from 35.5% to 42.7% of total traffic, and higher operating speeds on freeways of about 85 Km/hr comparing to those on surface roads of about 65 Km/Hr. Total PCU-Hr will reduce by 10% from that of the basic master plan network in 2012.

Among freeway alternatives, the table shows the highest efficiency from the view point of economy of VOC in the alternative 3, whose PCU-Km and PCU-Hr saving based on the Basic Master plan Network are the highest. However freeway network have to be finally decided taking other factors such as effect on land development, equal services for users, and so on.

Some of the demand response widening projects in the Basic Master plan Network can be canceled by absorbing demand in freeway network, and the additional land, represented by lane-Km, by the construction of freeway network is small, ranging from 3.8% to 9.3% of the land required in the Basic Network Master plan. If some of freeway links are constructed in the semi-desert area, the influence to agriculture land can be minimized.

Table 15-1-1 Characteristics of Freeway Master Plan Alternatives

Description		Basic Network	Freeway Network Alt-1	Alt-2	Alt-3
Surface Network					
Length	Km	20,195.0	20,329.0	20,262.0	20,297.0
PCU-Km(1,000)	PCU-Km	13,968	10,221	10,282	9,972
PCU-Hr	PCU-Hr	217,486	156,253	155,558	150,623
Total Trip	PCU	104,970	104,970	104,970	104,970
AV.Speed	Km/Hr	64.2	65.4	66.1	66.2
Av.Trip Length	Km	133.0	97.4	98.0	95.0
Av.Trip Time	Min	124.3	89.3	88.9	86.1
Freeway Network					
Length	Km		673.5	605.0	585.0
	(%)		6.2	5.6	5.5
PCU-Km(1,000)	PCU-Km		3,702	3,450	3,735
PCU-Hr	PCU-Hr		40,933	41,214	43,221
Entry Trip	PCU		40,005	37,312	44,775
	(%)		38.1	35.5	42.7
AV.Speed	Km/Hr		90.5	83.7	86.4
Av.Trip Length	Km		92.6	92.5	83.4
Av.Trip Time	Min		61.4	66.3	57.9
Total Network					
Length	Km	20,195.0	21,676.0	21,472.0	21,467.0
PCU-Km(1,000)	PCU-Km	13,968	13,923	13,733	13,706
PCU-Hr	PCU-Hr	217,486	197,186	196,772	193,843
Total Trip	PCU	104,970	104,970	104,970	104,970
AV.Speed	Km/Hr	64.3	70.6	69.8	70.7
Av.Trip Length	Km	133.0	132.6	130.8	130.6
Av.Trip Time	Min	124.3	112.7	112.5	110.8
Lane-Km 2012	Ln-Km	41,796.8	42,699.3	42,288.3	42,168.3
1992	Ln-Km	32,064.0			
Length	(%)	100.0	107.3	106.3	106.3
PCU-Km(1,000)	(%)	100.0	99.7	98.3	98.1
PCU-Hr	(%)	100.0	90.8	90.6	89.2
AV.Speed	(%)	100.0	91.1	100.0	98.8
Av.Trip Length	(%)	100.0	100.3	100.0	98.6
Av.Trip Time	(%)	100.0	110.2	100.0	99.8
Lane-Km	(%)	100.0	102.1	101.2	100.9
from 1992	(%)	130.4	133.2	131.9	131.5

15.2 Corridor Priorities and Operational Evaluation

15.2.1 Corridor Priorities based on Traffic Volume

The two freeway corridors in the primary highway network carrying the heaviest traffic volume, are the Cairo/Alex and the Cairo /Belbes /Zagazig /Mansoura/ Damietta. These two corridors are included in all the three alternative freeway networks, and the total length of the two corridors is about 300Km, whose construction cost is expected to be about 3,000 M.LE, equivalents to the possible additional investment amount estimated on the basis of RBA past records.

Therefore, these two corridors have been recommended to be studied as freeways by 2012. For priority selection between these two corridors based on traffic volume and their effect on the traffic of the surface network, an assignment run with 2012 OD has been carried out. The network used by this assignment run is composed from the 2012 whole basic network, superimposed on it these two freeway corridors. The network has a total length of 20,886 Km. Two-way links are counted once, while one way-link are counted twice.

Table 15-2-1 Comparison of the Traffic Volumes on the Two Proposed Corridors in the Year 2012

Description	Corridor Name	
	Cairo/Alexandria	Cairo/Bel./Mans./Dam
1)Network Total PCU-Hr	202,722.8	202,722.8
2)Network Total PCU-Kms(x1,000)	13,734.5	13,734.5
3)Freewaye PCU-Hr	17,139.8	11,000.6
4)Percentage Freeway PCU-Hr	8.45	5.43
5)Freeway PCU-Km (x1,000)	1,344.7	995.8
6)Percentage Freeway PCU-KM	9.79	7.25
7)Corridor Link Max. PCU Volume	4,544	3,882
8)Freeway Entry/Exit PCU Trips	11,019	13,758
9)Freeway Average Trip Dist.(Km)	122.04	72.38
10)Av. Trip Time on Freeway(Min)	93.33	47.97
11)Average Speed (Km/Hr)	78.46	90.52

The results of this assignment run are given in Table 15-2-1. The table presents the total PCU-Hr and the total PCU-Km on the whole network including the two freeway corridors. PCU-Hr carried by the Cairo/Alex corridor is estimated to be 17,139.8 representing 8.45% of the total network PCU-Hr. The corresponding percentage on the Cairo/Damietta corridor is estimated to be 5.43%. The percentage PCU-Km on the two freeways from the total PCU-Kms are 9.79 and 7.25 respectively. This shows that the Cairo/Alex corridor will attract more traffic than the Cairo/Damietta corridor.

The number of Entry/Exit trips to and from the freeways are

estimated to be 11,019 and 13,758. Dividing the PCU-Hr and the PCU-Kms on the two corridors by the corresponding number of trips using each corridor yields the average trip time and average trip length, respectively. The average trip distance and the average trip time on the Cairo/Alex is higher than those on the Cairo/Damietta. The average running speed on the Cairo/Alex corridor will be less than the Cairo/Damietta due to the heavier use of the former corridor.

The previously loaded network has been scanned also for the links which are heavily loaded in the year 2012. Fig. 15-2-1 shows the links having a V/C ratio more than 0.80. The Cairo /Alex is heavily loaded than all other corridors, including the Cairo/Damietta Freeway.

Cairo/Alex corridor will attract more traffic from the surface network than the Cairo/Damietta corridor. This conclusion gives the Cairo/Alex corridor the priority to be built before the Cairo/Damietta corridor.

15.2.2 The Effect of the Two Freeways on the Basic Master Plan

The building of the two candidate freeways will attract traffic from the surface network and will affect the new projects proposed for basic highway network. To determine the effect of building the Cairo/Alex and the Cairo/Damietta corridors on the proposed new projects of the basic surface network, two assignment runs have been carried out.

The first assignment run has been carried out with 2002 OD and the basic network for 2002 having the Cairo/Alex corridor superimposed on it. The resulted loaded network from this assignment run has been scanned for all links belonging to new proposed projects in the basic 2002 network and having their assigned traffic volume by 2002 less than 62% of their capacity by 1997. The upgrading of these links as proposed in the basic master plan for the period 1997/2002 has to be omitted due to the additional capacity provided by the construction of the new Cairo/Alex new freeway. The proposed basic master plan projects which have to be omitted are presented in Table 15-2-2.

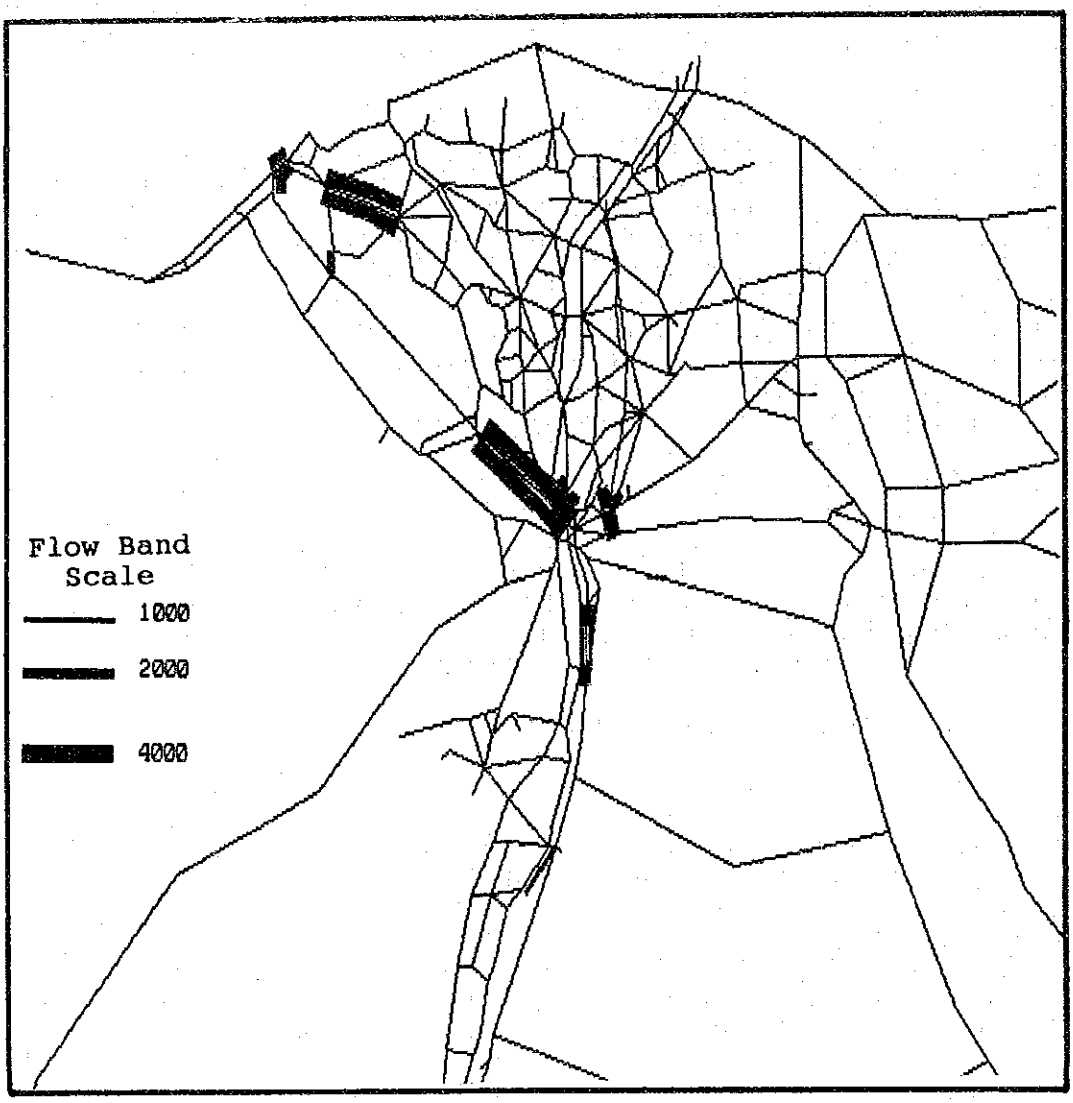


Fig. 15-2-1 Overloading of Lower Egypt Highway Network Having Both Freeway Corridors, Case V/C Equal or More Than 0.80

Table 15-2-2 Projects to be Canceled by Freeways (2002)

Project Code	Name	Length (Km)	Description
2010	Metobus/Edfina	2.0	Not to be improved to 4-lane div.
2006	Qanater/Qaliub	9.0	Not to be improved to 4-lane div.
2003	Alex. Desrt Rd.	204.0	Not to be improved to 6-lane div.
	Total	215.0	

The second assignment run uses the 2012 OD with the basic proposed 2012 network super-imposing on it the two candidate freeways and omitting from it the above mentioned demolished projects. The loaded network has been scanned for proposed master projects links having assigned traffic volume less than 62% of their 2002 link capacity. These link upgradings have to be omitted due to the additional capacity added by the Cairo/Damietta freeway. The description of these demolished links are presented in Table 15-2-3.

Table 15-2-3 Projects to be Canceled by Freeways (2012)

Project Code	Name	Length (Km)	Description
3032	Shebinkom/Quesna	11.0	Not to build to 4-lane Div.
3005	Damanhour/Delengat	36.0	Not to build to 4-lane Div.
3024	Qellin/Sheen	16.0	Not to build to 4-lane Div.
3025	Haikstep/Ismailia	61.0	Not to build to 6-lane Div.
	Total	124.0	

15.2.3 Operational Evaluation

For operational evaluation of a highway master plan having the two freeway corridors, two assignment runs have been carried out, the first with 2002 OD, and the second with 2012 OD. The first run used the revised 2002 basic network with the Cairo/Alex freeway corridor only, and the second used the 2012 revised basic network with the two corridors superimposed onto them. Table 15-2-4 contains the results of these assignment runs. For comparison purpose, this table contains the results of the 2002 and 2012 assignment runs for the final basic networks without freeways, and also the operational indices of the present base year 1992.

Table 15-2-4 Operational Evaluation of the Revised Basic Network with the Freeway Corridors

Item	Network	With Freeways	Basic Master plan	With Freeways	Basic Master plan
Description	1992	2002	2002	2012	2012
1 Link Length (Km)	15,888	18,994	18,660	20,814	20,195
2 Peak Hour PCU's Trips	44,340	88,110	88,110	104,970	104,970
3 Total PCU-Hr	76,293.3	170,948.2	179,717.9	203,388.5	217,485.5
4 Total PCU-Km (x 1000)	4,958.8	10,942.5	11,180.5	13,735.6	13,958.0
5 Average Speed Km/Hr	65.00	64.01	62.21	67.53	64.18
6 Average Tr. Time (Min)	103.24	116.41	122.38	116.26	124.31
7 Average Tr. Length (Km)	111.83	124.19	126.89	130.85	132.97
8 Average V/C	0.43	0.53	0.53	0.53	0.52
9 Percent by Level of Service					
A	59	37	35	34	31
B	22	22	20	22	22
C	10	14	28	25	34
D	7	20	13	14	10
E	2	7	5	5	3

The total PCU-Hr dropped from 179,717.9 to 170,948.2 in 2002 and from 217,485.5 to 203,388.5 in 2012 which corresponds to a reduction in the daily PCU-Hr equal 109,621 in the year 2002 and daily 176,213 PCU-Hr in the year 2012.

The average trip time in the year 2002 decreases from 122.4 min. for the basic network to 116.4 min. for the revised network with freeway including the Cairo/Alex only, i.e. by 4.9%. The percentage decrease in 2012 with the two freeway corridors included in the network amounts to 6.4%. The corresponding percentage decrease in the average trip distance is however less than that and equals 2.1% and 1.6% respectively, which means an increase in the average speeds for the network with the freeways. The 2012 network with freeway offers a higher average speed than that of the present 1992 average speed. These values are calculated all over the network and not for the movements using the freeways only.

15.3 Freeway Plan and Cost Estimate

15.3.1 Freeway Route

These freeways are planned as 6 lane divided, full access controlled highways either on embankment or viaduct, having design speed of 140Km/hr. This design speed corresponds to 120 Km/hr overall average speed. Traffic from surface roads can access to freeways only at interchanges, which were allocated at every 30 - 50 Km interval. Cairo - Alex freeway has 6 interchanges including those at the beginning and end, and Cairo - Damietta freeway has 8 interchanges. Fig. 15-3-1 shows the typical cross sections of 6 lane freeway.

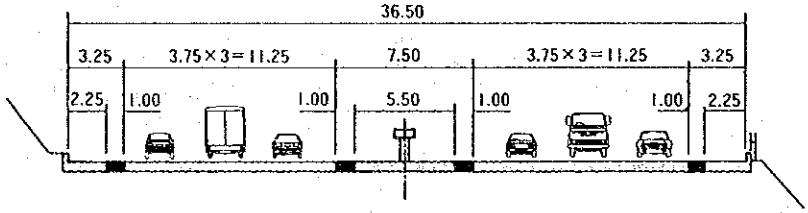


Fig. 15-3-1 Typical Cross Section of Freeway
(1) Earth Work Section

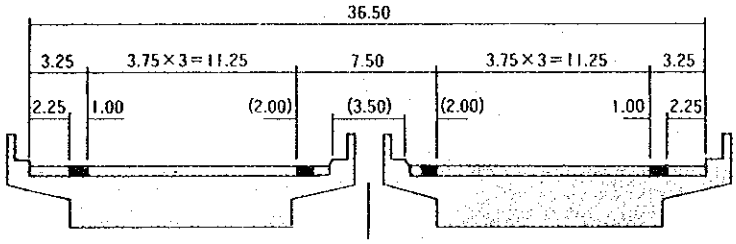


Fig. 15-3-1 Typical Cross Section of Freeway
(2) Viaduct Section

Cairo - Alex freeway is planned along Nile Rosetta branch and Nobaria canal, so that almost entire route can run in semi-desert area and will have straight alignment from Cairo Ring Road to Alexandria city center without serious interference to agriculture land. The total length is 169.0 Km.

Cairo - Damietta freeway is planned from Cairo Ring Road along Heikestep - Belbis Road, Belbis - Zagagiz - Mansura road and to Damietta along Nile Damietta branch. Entire length except for the section Heikestep - Belbis runs in agriculture land. The total length is 156.0 Km.

15.3.2 Toll Level

The freeways were planned as toll roads. The toll system are classified into two types of distance related toll system and fixed toll system. The toll shall be charged to road users in accordance with their benefit, and at the same time the system shall not be complicated. In the former system, a ticket, which shows the entering point will be handed to a driver and toll will be charged at the exit in accordance with the distance, while in the later system toll will be collected at one of entrance or exit or mid-point at a fixed rate. Distance related toll system is suitable for inter city highways and fixed toll system is for urban highways. The present toll system in Egypt follows the later system, however the former system was planned to these freeways because of the big differences of road users benefits by their usage.

The toll levels shall not exceed road users benefit and shall be decided to give maximum revenue. Fig. 15-3-2 shows the relationship between toll levels in terms of Pt/Km and annual total revenue of these two freeways in 2012. The drivers time value, which represent drivers willingness to pay in Table 15-3-1 was applied to convert toll charged to freeway users to additional travel time. These time values were calculated in accordance with the economic growth in real term.

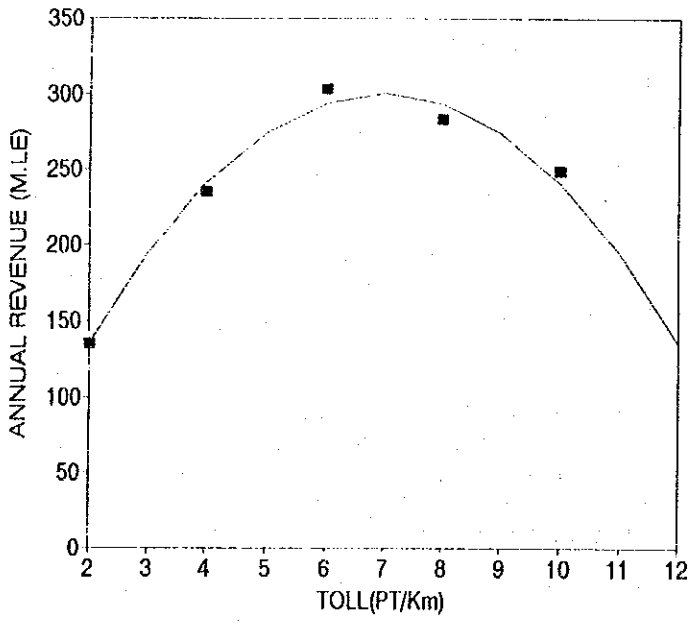


Fig. 15-3-2 Toll Level and Total Revenue

Table 15-3-1 Applied Time Value

Unit: LE/PCU/HR

YEAR	1992	1997	2002	2012
FACTOR	1.000	1.2823	1.7569	3.2980
P.CAR	4.585	5.879	8.055	15.120
TAXI	3.857	4.946	6.777	12.721
BUS	7.020	9.002	12.333	23.151
TRUCK	0.562	0.721	0.988	1.854
AVERAGE	3.370	4.321	5.921	11.114

Fig. 15-3-2 shows that 6 - 7 Pt/Km gives the maximum annual revenue or 300 M.LE in 2012. This toll level equivalents to about 10 LE for the section Cairo - Alexandria, where the present toll on the Desert Road is 1.0 LE. However this analysis proves there will be enough road users who will receive more benefit than toll he will pay even if the toll of 6 Pt/Km is charged, so that this study will apply the distance related toll of 6 Pt/Km.

15.3.3 Cost Estimate of Freeways

The cost of freeways was estimated based on the construction records of Cairo Ring Road Northern Arc, which was constructed at the suburban agriculture area of Cairo and has viaducts and culverts for local traffic at almost every 500m. The cost was estimated classifying the freeway routes into three categories of urban, agriculture and desert area. In urban area viaduct, in agriculture area 3.0 - 4.0 m high embankment, and in desert area 1.0m low embankment was assumed.

Land acquisition cost was estimated based on the information from RBA records about unit land cost while in desert area, no land cost was assumed.

The resulted cost for Cairo - Alexandria freeway is 1,116.1 M.LE and Cairo - Damietta freeway is 1,626.7 M.LE in financial terms.

Table 15-3-2 Estimated Cost of Freeways

(1) Financial Cost

Descriptions	Unit	QUANTITY			Unit Cost (M.LE)	COST(M.LE)		
		CAI-ALX	CAI-DMT	TOTAL		CAI-ALX	CAI-DMT	TOTAL
LENGTH								
HIGHWAY	Km	169.0	156.0	325.0		975.2	1263.4	2238.6
Urban Area	Km	5.0	14.0	19.0	36.0	180.0	504.0	684.0
Agric. Area	Km	54.0	110.0	164.0	5.6	302.4	616.0	918.4
Desert Area	Km	110.0	32.0	142.0	4.5	492.8	143.4	636.2
ACCESS	Km	2.5	18.0	20.5	5.6	14.0	100.8	114.8
TOTAL	Km	171.5	174.0	345.5				
No. of IC	No.	5	8	13	11.2	56.0	89.6	145.6
BRIDGE								
NILE	No.	0	0	0	86.0	0.0	0.0	0.0
MAIN CANAL	No.	1	4	5	7.2	7.2	28.8	36.0
LAND								
HIGHWAY	1000m2	5695.0	5742.0	11437.0		48.2	102.0	150.2
Urban Area	1000m2	125.0	350.0	475.0	40.0	5.0	14.0	19.0
Agric. Area	1000m2	2160.0	4400.0	6560.0	20.0	43.2	88.0	131.2
Desert Area	1000m2	3410.0	992.0	4402.0	0.0	0.0	0.0	0.0
ACCESS	1000m2	77.5	558.0	635.5	40.0	3.1	22.3	25.4
INTERCHANGES	1000m2	310.0	496.0	806.0	40.0	12.4	19.8	32.2
TOTAL	M.LE					1116.1	1626.7	2742.8
	(M.LE/Km)					6.60	10.43	8.44

(2) Economic Cost

Descriptions	Unit	QUANTITY			Unit Cost (M.LE)	COST(M.LE)		
		CAI-ALX	CAI-DMT	TOTAL		CAI-ALX	CAI-DMT	TOTAL
LENGTH								
HIGHWAY	Km	169.0	156.0	325.0		975.2	1263.4	2238.6
Urban Area	Km	5.0	14.0	19.0	36.0	180.0	504.0	684.0
Agric. Area	Km	54.0	110.0	164.0	5.6	302.4	616.0	918.4
Desert Area	Km	110.0	32.0	142.0	4.5	492.8	143.4	636.2
ACCESS	Km	2.5	18.0	20.5	5.6	14.0	100.8	114.8
TOTAL	Km	171.5	174.0	345.5				
No. of IC	No.	5	8	13	11.2	56.0	89.6	145.6
BRIDGE								
NILE	No.	0	0	0	86.0	0.0	0.0	0.0
MAIN CANAL	No.	1	4	5	7.2	7.2	28.8	36.0
LAND								
HIGHWAY	1000m2	5695.0	5742.0	11437.0		48.2	102.0	150.2
Urban Area	1000m2	125.0	350.0	475.0	40.0	5.0	14.0	19.0
Agric. Area	1000m2	2160.0	4400.0	6560.0	20.0	43.2	88.0	131.2
Desert Area	1000m2	3410.0	992.0	4402.0	0.0	0.0	0.0	0.0
ACCESS	1000m2	77.5	558.0	635.5	40.0	3.1	22.3	25.4
INTERCHANGES	1000m2	310.0	496.0	806.0	40.0	12.4	19.8	32.2
TOTAL	M.LE					1116.1	1626.7	2742.8
	(M.LE/Km)					6.60	10.43	8.44

15.3.4 Investment Schedule of Freeways

The construction of freeways are planned to start at the first year of the next five year period and are planned to be completed by 2012. Table 15-3-3 shows the investment schedule of two freeway projects. First two year will be spent for land acquisition of the first freeway of Cairo - Alexandria and this freeway will be completed at the end of 2005. The land acquisition of the second freeway of Cairo - Damietta is planned to start in 2003, so that almost same

invest amount will be allocated for 12 years.

Table 15-3-3 Investment Schedule of Freeways

YEAR	FINANCIAL COST (M.LE)					ECONOMIC COST (M.LE)				
	CAI-ALX		CAI-DMT		TOTAL	CAI-ALX		CAI-DMT		TOTAL
	Land	Const	Land	Const		Land	Const	Land	Const	
1998	31.9				31.9	31.9				31.9
1999	31.9				31.9	31.9				31.9
2000		199.4			199.4		265.4			265.4
2001		199.4			199.4		265.4			265.4
2002		199.4			199.4		265.4			265.4
2003		151.4	48.0		199.4		217.4	48.0		265.4
2004		151.4	48.0		199.4		217.4	48.0		265.4
2005		151.4	48.0		199.4		217.4	48.0		265.4
2006				211.8	211.8				273.5	273.5
2007				211.8	211.8				273.5	273.5
2008				211.8	211.8				273.5	273.5
2009				211.8	211.8				273.5	273.5
2010				211.8	211.8				273.5	273.5
2011				211.8	211.8				273.5	273.5
2012				211.8	211.8				273.5	273.5
TOTAL	63.7	1052.4	144.1	1482.6	2742.8	63.7	1448.5	144.1	1914.2	3570.5

15.4 Economic Evaluation of Freeways and Freeway Master plan

15.4.1 Economic Evaluation of Freeways

Economic benefit of two freeways is defined as VOC saving compared with VOC of the revised basic master plan network. VOC of the revised basic master plan network and that with freeways are shown in Fig. 15-4-1. The economic cash flow of this benefit and cost is given in Table 15-4-1. After the long term target year of 2012, the same amount of VOC saving is assumed for 10 years until 2022. The cash flow does not include the residual value of the freeways after this period. EIRR, NPV with 12% of discount rate and B/C are calculated at 25.17%, 2,509.2 M.LE and 2.47 respectively, which prove high economic returns of the freeway projects.

Table 15-4-1 Economic Cash Flow of Freeways

Unit: M.LE

YEAR		COST			BENEFIT	B-C	DISCOUNTED (12%)		
		INVEST	OM COST	TOTAL			COST	BENEFIT	B-C
1	1998	31.9		31.9	0.0	-31.9	31.9		-31.9
2	1999	31.9		31.9	0.0	-31.9	28.4		-28.4
3	2000	265.4		265.4	0.0	-265.4	211.6		-211.6
4	2001	265.4		265.4	0.0	-265.4	188.9		-188.9
5	2002	265.4		265.4	0.0	-265.4	168.7		-168.7
6	2003	265.4		265.4	0.0	-265.4	150.6		-150.6
7	2004	265.4		265.4	0.0	-265.4	134.5		-134.5
8	2005	265.4		265.4	192.5	-73.0	120.1		-120.1
9	2006	273.5	29.0	302.4	478.0	175.6	122.1	193.1	70.9
10	2007	273.5	29.0	302.4	653.4	350.9	109.1	235.6	126.5
11	2008	273.5	29.0	302.4	666.9	364.4	97.4	214.7	117.3
12	2009	273.5	29.0	302.4	872.4	570.0	86.9	250.8	163.9
13	2010	273.5	29.0	302.4	1050.6	748.2	77.6	269.7	192.0
14	2011	273.5	29.0	302.4	1083.7	781.3	69.3	248.4	179.0
15	2012	273.5	29.0	302.4	2057.9	1755.4	61.9	421.1	359.2
16	2013		38.3	38.3	2057.9	2019.6	7.0	376.0	369.0
17	2014		38.3	38.3	2057.9	2019.6	6.2	335.7	329.4
18	2015		38.3	38.3	2057.9	2019.6	5.6	299.7	294.1
19	2016		38.3	38.3	2057.9	2019.6	5.0	267.6	262.6
20	2017		38.3	38.3	2057.9	2019.6	4.4	238.9	234.5
21	2018		38.3	38.3	2057.9	2019.6	4.0	213.3	209.4
22	2019		38.3	38.3	2057.9	2019.6	3.5	190.5	186.9
23	2020		38.3	38.3	2057.9	2019.6	3.2	170.1	166.9
24	2021		38.3	38.3	2057.9	2019.6	2.8	151.8	149.0
25	2022		38.3	38.3	2057.9	2019.6	2.5	135.6	133.1
TOTAL		3,570.5	585.6	4,156.1		23,477.9	1,703.3	4,212.5	2,509.2

EIRR= 25.17
NPV= 2,509.2
B/C= 2.47

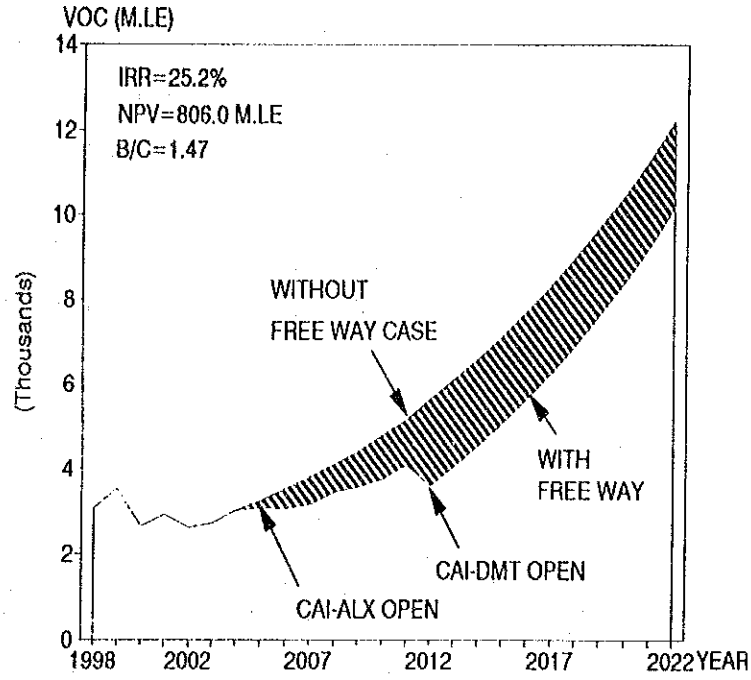


Fig. 15-4-1 Evolution of VOC of freeways

15.4.2 Economic Evaluation of Master Plan with Freeways

The master plan network with freeways compared with Do-nothing case was economically evaluated as the same manner as the basic master plan network. VOC saving beyond the long term target year of 2012 was assumed as the same amount as in 2012. No residual value of network was counted. The resulted IRR, NPV with 12% discount rate and B/C are calculated at 78.1%, 17,707.8 M.LE and 9.53 respectively, which are slightly lower than those in the basic master plan network, however still high economic returns of the master plan network with freeways are proved by these figures. The economic cash flow is presented in Table 15-4-2.

Table 15-4-2 Economic Cash Flow of Freeway Master Plan

	YEAR	COST			BENEFIT	B-C	DISCOUNTED (12%)		
		BASE NETWORK	FREEWAY	TOTAL			COST	BENEFIT	B-C
0	1992	0.0		0.0	0.0	0.0	0.0	0.0	0.0
1	1993	385.7		385.7	0.9	-384.8	344.4	0.8	-343.6
2	1994	334.4		334.4	54.6	-279.8	266.6	43.5	-223.0
3	1995	253.1		253.1	491.5	238.4	180.2	349.8	169.7
4	1996	262.8		262.8	571.3	308.5	167.0	363.1	196.0
5	1997	234.7		234.7	1,345.9	1,111.2	133.2	763.7	630.5
6	1998	160.0	31.9	191.9	1,853.3	1,661.4	97.2	938.9	841.7
7	1999	124.6	31.9	156.5	1,904.6	1,748.1	70.8	861.5	790.7
8	2000	132.9	265.4	398.3	3,559.0	3,160.7	160.9	1,437.4	1,276.6
9	2001	148.4	265.4	413.8	3,680.8	3,267.0	149.2	1,327.3	1,178.1
10	2002	138.6	265.4	404.0	5,281.4	4,877.4	130.1	1,700.5	1,570.4
11	2003	140.3	265.4	405.7	5,195.7	4,790.0	116.6	1,493.7	1,377.0
12	2004	140.6	265.4	406.0	5,863.1	5,457.1	104.2	1,504.9	1,400.7
13	2005	147.8	265.4	413.2	6,363.5	5,950.3	94.7	1,458.3	1,363.6
14	2006	159.2	273.5	432.7	6,448.9	6,016.2	88.5	1,319.6	1,231.0
15	2007	127.4	273.5	400.9	6,917.7	6,516.8	73.2	1,263.8	1,190.6
16	2008	142.0	273.5	415.5	7,438.2	7,022.7	67.8	1,213.3	1,145.6
17	2009	262.3	273.5	535.8	7,695.2	7,159.4	78.0	1,120.8	1,042.7
18	2010	298.0	273.5	571.5	8,169.8	7,598.3	74.3	1,062.4	988.1
19	2011	242.4	273.5	515.9	8,290.9	7,775.0	59.9	962.6	902.7
20	2012	248.9	273.5	522.4	9,961.7	9,439.3	54.2	1,032.7	978.5
21	2013				9,961.7	9,961.7		922.0	922.0
22	2014				9,961.7	9,961.7		823.3	823.3
23	2015				9,961.7	9,961.7		735.1	735.1
24	2016				9,961.7	9,961.7		656.3	656.3
25	2017				9,961.7	9,961.7		586.0	586.0
	TOTAL	4,084.1	3,570.7	7,654.8	91,088.0	83,433.2	2,511.0	23,941.4	17,707.8

IRR=	78.1
NPV=	17,707.8
B/C=	9.53

15.5 Financial Evaluation of Freeway

The following loan condition is assumed to evaluate financial feasibility of freeway projects.

(1) Interest rate : 8% p.a.
(2) Pay back period : 25 years
(3) Grace period : 5 years
(4) Pay back condition : parity installment of principal

Inflation rate was not taken into account in both cost and toll rate. The evaluation was made by the single year balance of annual expenditure and revenue, and its accumulated balance. Table 15-5-1 and Fig. 15-5-1 show these balances. After 24 years from the initiation of the project in 2021, the accumulated balance will turn to surplus, which implies that the freeway projects has a possibility to be implemented as a self-sustained project, if a long term loan with an interest rate of less than 8% can be applied.

Table 15-5-1 Financial Cash Flow of Freeways

YEAR		COST				REVENUE (M.LE)	BALANCE(M.LE) SINGLE YEAR	ACCUMULATED
		INVEST	INTEREST	PAY BACK	OM COST			
1	1998	31.9	2.5	0.0			-2.5	-2.5
2	1999	31.9	5.1	0.0			-5.1	-7.6
3	2000	199.4	21.0	0.0			-21.0	-28.7
4	2001	199.4	37.0	0.0			-37.0	-65.7
5	2002	199.4	53.0	0.0			-53.0	-118.7
6	2003	199.4	68.9	1.6			-70.5	-189.2
7	2004	199.4	84.7	3.2			-87.9	-277.1
8	2005	199.4	100.4	13.2			-113.6	-390.7
9	2006	211.8	116.3	23.1	21.0	99.0	-61.5	-452.2
10	2007	211.8	131.4	33.1	21.0	115.2	-70.4	-522.6
11	2008	211.8	145.7	43.1	21.0	131.4	-78.4	-601.0
12	2009	211.8	159.2	53.0	21.0	147.6	-85.6	-686.6
13	2010	211.8	171.9	62.8	21.0	163.8	-91.9	-778.6
14	2011	211.8	183.8	72.7	21.0	180.0	-97.6	-876.2
15	2012	211.8	195.0	82.1	21.0	196.2	-101.9	-978.1
16	2013		188.4	91.1	50.7	328.9	-1.2	-979.3
17	2014		181.1	99.5	50.7	354.8	23.5	-955.8
18	2015		173.2	107.5	50.7	380.7	49.4	-906.4
19	2016		164.6	114.9	50.7	406.6	76.4	-830.0
20	2017		155.4	121.9	50.7	432.5	104.6	-725.4
21	2018		145.6	121.9	50.7	458.4	140.2	-585.2
22	2019		135.9	121.9	50.7	484.3	175.8	-409.4
23	2020		126.1	121.9	50.7	510.2	211.5	-197.9
24	2021		116.4	121.9	50.7	536.0	247.1	49.2
25	2022		106.6	121.9	50.7	561.9	282.8	332.0
						FIRR=	5.57	

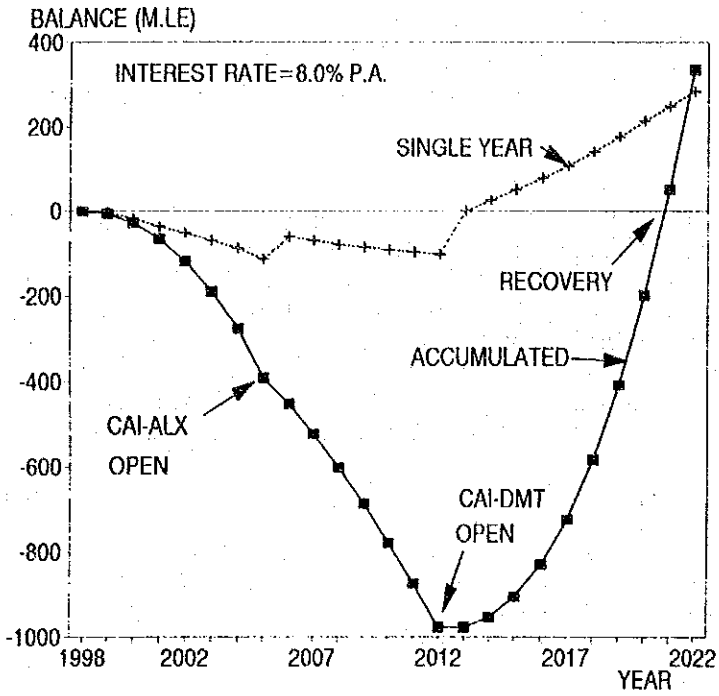


Fig. 15-5-1 Financial Balance of Freeways

CHAPTER 16 ROAD PASSENGER TRANSPORT MASTER PLAN

16.1 General

16.1.1 Purpose

Travel demand on the interzonal public road transport service is estimated to increase at a growth rate of 5.3% per annum from 1992 to 2012, e.g. 825,000 person trips per day of 1992 to 2,338,000 in 2012. In order to meet this growth of demand, transport facilities and service are necessary to be improved, and the improvement will sustain the development of the country.

Currently, intercity buses are operating by the four bus companies having their exclusive operation area. This situation will not arise heavy competition among them and may arise inefficient operation, however taking strong public nature of the bus operation as a minimum public service into consideration, no government enforcement will be needed against the present operational situation.

The objectives of the master plan of the road public transport service are to present plans and policies by dividing the plan into the following subjects.

- -Service reclassification between buses and taxis.
- -Replacement and increase of bus fleet.
- -Terminal improvement plan.
- -Administrative functions and system development.

16.1.2 Phases

The timing of projects in the master plan will be divided into 3 phases : the short (1993-1997), the medium (1998-2002) and the long term (2003-2012).

16.2 Service Reclassification between Buses and Taxis

16.2 1 Cost Comparison between Taxis and Buses

Inter city public passenger transport demand is served by buses and taxis, where buses have different classes of service and taxis are in one class using 7-16 seat vehicles. Currently they are operating on the same route between a city to the other by sharing passengers. It is said when the demand passengers are large the service by bus is advantageous in terms of economic cost. In order to find the relationship between the economic cost of transport per passenger and the passenger volume, an analysis was undertaken in Chapter 5.3 of this report. The followings are the excerpts of it:

a. Traveling passengers were grouped by distance between the origin and destination. Different passenger volumes were assumed from a small to a large number in each distance group, and hourly distribution of departure trips was determined for morning and afternoon respectively. Passengers were assumed to appear at the terminal at an averaged time interval within the hourly volume. A 12 hour operation was assumed and the return trips are assumed to have the same passengers of the departure.

b. Buses or taxis wait at the terminal and when the passengers come up to the averaged occupants, then the vehicle starts to the destination. No passengers on and off on the way are assumed. After arriving the destination terminal, the vehicle waits for passengers going to the origin city under the same conditions. With the averaged occupants the vehicle returns the city. The second and the following vehicles move in the same manner.

c. The above pattern of movements can determine the number of vehicles on the route since the Inter city licensing is for a certain route operation. Taxi moves much frequently as the seats are less than the bus. They wait in longer hours in the afternoon than the morning busy hours.

d. From the number of vehicles assigned on the route based on the passenger volume and the round trip travel time, the fixed cost portion of VOC can be estimated, while number of trips and the distance to the destination are used to estimate the variable VOC. The total of fixed and variable costs on one route differs from the other even on the same distance if passenger volumes are not same. Examples are shown in Appendix Fig. 5-3-1 in Chapter 5 where the demand volume in passengers are on x axis and the averaged economic VOC per passenger carried is on y axis. When the passengers are small the bus cost per person is high; but when the passengers

become larger, the cost of bus goes down as shown in the figure although the tendencies of going down are different depending on the classified distances.

e. The turning point at which the bus cost curve goes below the taxi curve was found in every distance group and these turning points with the volume and the distance were drawn in Fig. 5-3-1 of the chapter 5. The regression analysis was done to determine the initial model formula a, and the formula b was found after adjustment of a. to the surveyed person trip data in 1992. The curve b in Fig. 5-3-1 is copied in the following Fig. 16-2-1 as b. When the passengers are larger than the point on the curve, the use of bus is economically efficient. If the volume is below the curve taxi service is better in terms of economic cost.

f. It is likely the share of microbuses will increase from 50% in 1992 to 67% in 2012. This will reduce the cost of taxis a little and alter the value of parameter of the formula b. in Fig. 16-2-1, which would move upward by 33% under the same method in 5.3 of Chapter 5. The upward shift of 33% (22930/17250=1.33 in Fig. 5-3-1) is applied to the parameter of b resulting in c in Fig.16-2-1. This c. curve is used in the modal split of passengers on public modes on roads in the future years. Peugeot taxi will reduce the share because of its disadvantage in the cost per person, but some owners are likely to have other opportunities using the Peugeot to get revenue because of its flexibility in serving informal activities. With this reasoning the share of 67%, not 100%, is assumed for microbuses.

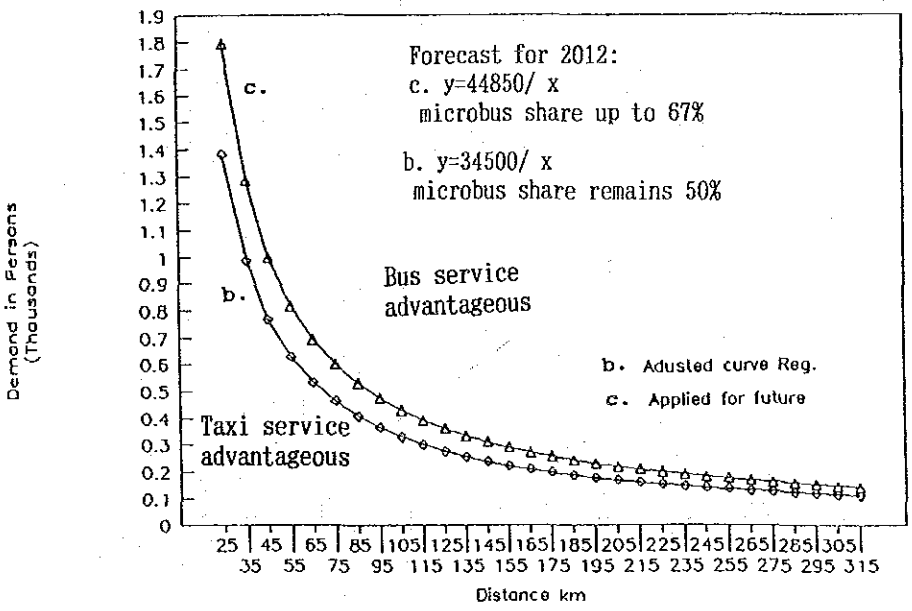


Fig. 16-2-1 Demand by Passengers and Distance

16.2.3 Application to the Year 2012

The model was applied to the passenger OD matrices of public road transport estimated for 2012. It is found zones with large trips will increase the use of buses but those using taxis for small passenger trips will remain to use taxis as examples are found in the zones of Upper Egypt and less populated areas. The passenger trips aggregated to each of the 29 zones are in Table 16-2-1. In total the buses will carry 58% of the passengers and taxis 42% in 2012 as shown in Table 16-2-2.

Table 16-2-1 Passengers on Bus and Taxi in 2012

Zone	Passengers in 2012				Share in %			
	Bus		Taxi		Bus		Taxi	
	Gen	Atr	Gen	Atr	Gen	Atr	Gen	Atr
1 CAI	190,471	187,929	177,274	168,208	51.8	52.8	48.2	47.2
2 GIZ	29,402	29,103	38,042	38,839	43.6	42.8	56.4	57.2
3 QAL	60,091	56,727	48,885	51,110	55.1	52.6	44.9	47.4
4 SKS	60,018	55,057	81,203	86,083	42.5	39.0	57.5	61.0
5 SKN	39,133	34,983	34,098	38,043	53.4	47.9	46.6	52.1
6 DKE	91,631	92,770	55,580	54,274	62.2	63.1	37.8	36.9
7 DKW	37,155	37,960	28,097	25,771	56.9	59.6	43.1	40.4
8 DAM	68,211	66,969	19,043	21,383	78.2	75.8	21.8	24.2
9 PTS	33,837	33,568	6,898	7,529	83.1	81.7	16.9	18.3
10 ISM	32,581	30,213	15,993	19,271	67.1	61.1	32.9	38.9
11 SUZ	21,743	25,966	10,625	7,374	67.2	77.9	32.8	22.1
12 MIF	68,277	77,158	65,876	58,254	50.9	57.0	49.1	43.0
13 GHS	97,642	88,706	47,425	55,867	67.3	61.4	32.7	38.6
14 GHN	71,537	73,207	19,547	20,475	78.5	78.1	21.5	21.9
15 KAF	46,407	47,259	38,016	37,445	55.0	55.8	45.0	44.2
16 BHS	20,595	27,254	41,813	35,882	33.0	43.2	67.0	56.8
17 BHN	72,279	73,005	22,774	21,600	76.0	77.2	24.0	22.8
18 ALX	147,147	159,459	39,730	31,826	78.7	83.4	21.3	16.6
19 WDS	10,213	11,186	7,626	7,039	57.3	61.4	42.7	38.6
20 SIN	991	990	11,268	11,419	8.1	8.0	91.9	92.0
21 FAY	26,854	26,176	13,090	14,159	67.2	64.9	32.8	35.1
22 BES	28,884	28,469	24,026	24,868	54.6	53.4	45.4	46.6
23 MYA	13,182	20,761	40,427	33,242	24.6	38.4	75.4	61.6
24 ASY	11,490	12,228	31,491	30,856	26.7	28.4	73.3	71.6
25 NEW	527	433	825	890	39.0	32.7	61.0	67.3
26 SOH	22,529	21,977	26,025	26,209	46.4	45.6	53.6	54.4
27 QEN	48,448	34,363	17,149	32,388	73.9	51.5	26.1	48.5
28 ASW	10,017	6,925	4,881	7,829	67.2	46.9	32.8	53.1
29 RED	3,421	3,912	5,605	5,199	37.9	42.9	62.1	57.1
Total	1,364,713	1,364,713	973,332	973,332	58.4	58.4	41.6	41.6

Table 16-2-2 Passengers by Buses and Taxis,2012
(persons '000)

	Buses	Taxis	Total
1.With rearrangement			
Passengers	1,365	973	2,338
percentage	58 %	42 %	100 %
2.Without rearrangement			
(continuation of the existing trend)			
Passengers	1232	1106	2338
Percentage	53 %	47 %	100 %
3.Shift			
Passengers	+133	-133	
Percentage	+5 %	-5 %	

The economic cost method suggests operation by the mixture of taxis and buses on the same route should be rearranged. One type, taxis or buses, should serve the route depending on the distance and passenger demand except several large cities. In order to restructure the service routes and licensing along with this principle, the following actions are necessary in the government side:

-1. A detailed study on the corridor or region to determine the reclassification together with the cost analysis.
-2. Establish and strengthen the administrative system and functions in enforcing and monitoring the service.

16.3 BUS FLEET

16.3.1 Bus Service Development

Changes in bus fleet from 1983 to 1991 were studied by reviewing the ENTS-III (1984) and the data of 1991 shown by the four bus companies. They are shown in Table 16-3-1. The operationable fleet increased by 1.07 times during those 8 years, while their average travel distance and bus-km increased by 1.30 times and 1.38 times respectively in the same period. Public buses were under the pricing policy of the government not to increase the fares in order to minimize the effects of changes in general price level on people in low income classes. The bus companies managed to overcome this constraint by using the vehicles as much as they could and subsequently reduced vehicle replacement. Financial consequences of management in these years were discussed in 16.3.2 afterward.

Table 16-3-1 Changes in Performance of the Bus Companies 1983 and 1991

Item	(b) 1982/83	(c) 1990/91	b/c	Growth p.a
1. No of buses				
-1 Operationa	3370	3591	1.066	0.8 %
-2 In daily O	2627	2873	1.094	1.1 %
-3 Utilizatio	78 %	80 %	-	-
2. Bus-km(in mi	259.5	358.7	1.382	4.1 %
3. Average run-	77,000	99,900	1.297	3.3 %

Source b: ENTS III (1984)
c: Annual Reports (1990/91) and Files in TPA

There were differences in increases of the fleet volume and operations by service class. In the case of the total of the four companies, buses used in common service increased by 1.03 times and those used in express lines there were a decrease of 5% in the period from 1986 to 1991. The AC and special seat buses, both services were not under the pricing constraint policy of the government, increased by 1.39 times in the same period. The travel-km increased in all classes, but the AC and special seat class had a large increase of 1.55 times with a remarkable increase in the revenue of 3.10 times from 1986 to 1991. These are shown in Table 16-3-2.

Table 16-3-2 Bus Services by Class

(The 4 companies and total)

Company / Class	Number of vehicles							Vehicle-km in million							Revenue in L.E million						
	1986	1987	1988	1989	1990	1991	91/86	1986	1987	1988	1989	1990	1991	91/86	1986	1987	1988	1989	1990	1991	91/86
Upper Egypt																					
Common	404	424	413	445	430	438	1.08	26.0	28.6	31.2	35.0	35.4	37.4	1.44	5.4	6.4	7.6	9.7	10.3	12.1	2.24
Express	176	184	179	194	192	186	1.06	23.0	25.3	29.6	32.8	31.0	31.7	1.38	8.0	9.6	11.4	14.7	15.0	16.5	2.06
Air- Con	300	315	308	311	333	336	1.12	51.0	56.1	59.2	62.2	67.6	70.9	1.39	20.1	24.1	28.5	36.5	46.1	51.0	2.54
Total	880	923	900	950	955	960	1.09	100.0	110.0	120.0	130.0	134.0	140.0	1.40	33.5	40.1	47.5	60.9	71.4	79.6	2.38
East Delta																					
Common	460	461	435	450	440	400	0.87	38.0	38.0	38.0	35.0	34.0	27.0	0.71	19.8	21.9	25.9	27.0	29.6	29.1	1.47
Express	216	230	230	246	241	229	1.06	29.0	30.0	30.0	30.0	28.0	28.0	0.97	8.9	11.0	13.7	16.3	18.0	20.6	2.31
Air- Con	161	165	165	164	171	182	1.13	27.0	27.0	27.0	28.0	28.0	30.0	1.11	9.7	11.5	14.2	15.7	19.6	23.7	2.44
Special St	15	15	25	30	49	63	4.20	3.0	2.0	4.0	6.0	9.0	11.0	3.67	1.4	1.6	3.4	4.5	8.8	12.9	9.21
Total	852	871	855	890	901	874	1.03	97.0	97.0	99.0	99.0	99.0	96.0	0.99	39.8	46.0	57.2	63.5	76.0	86.3	2.17
Middle Delta																					
Common	311	379	350	404	303	379	1.22	19.7	22.6	21.9	24.8	17.8	22.8	1.16	7.2	9.5	11.5	14.3	11.0	13.8	1.92
Express	407	407	407	358	447	328	0.81	39.6	37.3	39.2	35.2	41.0	30.6	0.77	13.0	14.1	17.3	17.3	23.2	16.8	1.29
Air- Con	5	5	8	12	24	65	13.00	0.6	0.6	1.0	1.4	2.8	7.8	13.00	0.3	0.3	0.7	1.0	2.0	7.9	26.33
Special St	0	0	13	26	26	28	-	0.0	0.0	1.8	3.6	3.4	3.8	-	0.0	0.0	1.3	2.6	2.5	4.1	-
Total	723	791	778	800	800	800	1.11	59.9	60.5	63.9	65.0	65.0	65.0	1.09	20.5	23.9	30.8	35.2	38.7	42.6	2.08
West Delta																					
Common	222	220	206	203	230	226	1.02	10.0	9.0	8.5	8.0	11.0	10.0	1.00	2.6	2.6	4.2	5.4	7.7	7.8	3.00
Express	178	180	133	167	188	185	1.04	19.0	21.0	21.5	21.0	27.0	27.0	1.42	4.2	5.6	5.9	7.1	8.7	8.9	2.12
Air- Con	60	66	76	84	38	47	0.78	9.0	10.0	123.5	14.0	7.0	9.0	1.00	4.5	4.7	5.0	5.4	3.7	5.4	1.20
Special St	0	0	6	22	24	32	-	0.0	0.0	1.5	5.0	6.0	8.0	-	0.0	0.0	1.0	3.2	4.3	6.5	-
Total	460	466	421	476	480	490	1.07	38.0	40.0	155.0	48.0	51.0	54.0	1.42	11.3	12.9	16.1	21.1	24.4	28.6	2.53
Total of the 4 companies																					
Common	1397	1484	1404	1502	1403	1443	1.03	93.7	98.2	99.6	102.8	98.2	97.2	1.04	35.0	40.4	49.2	56.4	58.6	62.8	1.79
Express	977	1001	949	965	1068	928	0.95	110.6	113.6	120.3	119.0	127.0	117.3	1.06	34.1	40.3	48.3	55.4	64.9	62.8	1.84
AC & Spec	541	566	601	649	665	753	1.39	90.6	95.7	218.0	120.2	123.8	140.5	1.55	36.0	42.2	54.1	68.9	87.0	111.5	3.10
Total	2915	3051	2954	3116	3136	3124	1.07	294.9	307.5	437.9	342.0	349.0	355.0	1.20	105.1	122.9	151.6	180.7	210.5	237.1	2.26

Source: Each bus company, December 1992

Notes: No. of vehicles Middle and West are the total hold inthe companies, while others show operationable buses.
In other items, minor differences from Table 15-3-1 remain.

16.3.2 Fleet Increase

However, the vehicle age distribution of the buses in the four companies changed as shown in Fig. 16-3-1 and Table 16-3-3. As known already in this period, bus companies were under the pricing policy of the government not to increase the fare level in order to care for the low income class of the people. This had resulted in less revenue and less replacement of old buses. The aged bus more than 9 years in use increased from 12% in 1983 to 43% in 1991. Table 16-3-4 shows the buses in 1992 classified by the year of acquisition.

Table 16-3-3 Bus Age Distribution : 1982 and 1992
(4 Companies)

	Years	1982(a) Fleet	%	1991(b) Fleet	%
1	0---3	1,320	38.7	704	19.6
2	4---6	1,188	34.9	714	19.8
3	7---8	477	14.0	624	17.3
4	9---	423	12.4	1,556	43.2
5	Total	3,408	100.0	3,598	100.0
6	Daily Use	2,627	77.1	2,873	79.8

Source a: from ENTS III (1984)
b: by the four bus companies (1990 & 1991)

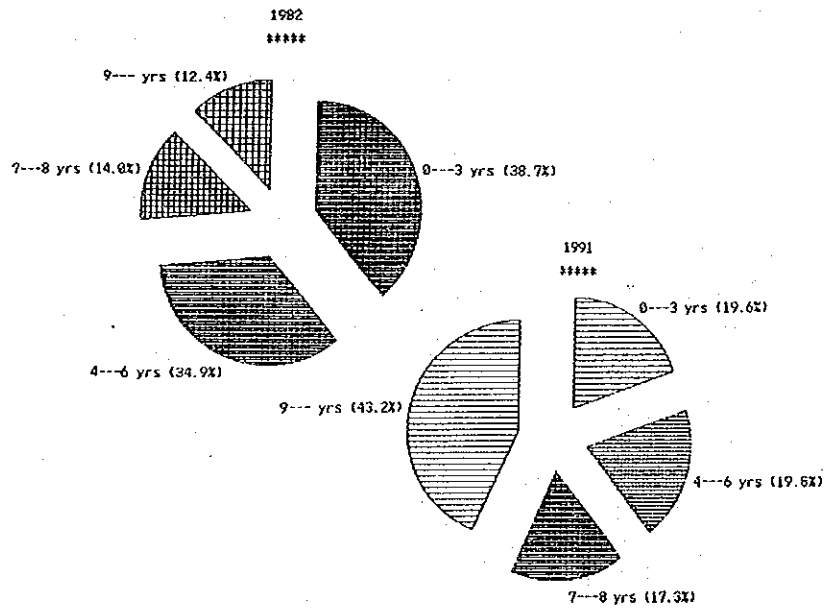


Fig. 16-3-1 Bus Age Distribution : 1982 and 1991
(4 Bus Companies)

Table 16-3-4 Vehicle Age and Service Type of Buses (The 4 Bus Companies)

(Nos.in mid-1992)

Comp.Name & Bus Class	No.of Buses by Year													
	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	<1980
UPPER EGYPT														
common	0	0	0	0	0	0	0	0	0	24	34	40	25	105
express	0	0	0	29	31	0	87	112	167	47	66	68	108	0
air_cond.	0	11	48	20	48	0	15	0	15	0	0	10	21	0
spec.seat	0	28	24	0	0	0	0	0	0	0	0	0	0	0
Total	0	39	72	49	79	0	102	112	182	71	100	118	154	105
EAST DELTA														
common	0	0	0	0	33	0	34	40	0	24	11	89	132	3
express	16	24	19	12	19	31	73	0	0	29	78	37	0	0
air_cond.	0	35	8	36	47	0	42	50	105	4	0	11	18	0
spec.seat	21	12	0	0	0	0	2	24	6	0	0	0	0	0
Total	37	71	27	48	99	31	151	114	111	57	89	137	150	3
MIDDLE DELTA														
common	0	0	0	0	0	26	56	20	49	101	43	43	43	43
express	19	0	0	79	20	68	3	45	0	0	16	16	16	16
air_cond.	0	18	0	8	5	25	0	0	0	0	0	0	0	0
spec.seat	0	19	12	0	0	0	0	0	0	0	0	0	0	0
Total	19	37	12	87	25	119	59	65	49	101	59	59	59	59
WEST DELTA														
common	0	0	0	0	0	0	0	0	0	0	6	0	0	59
express	0	0	0	0	30	5	42	0	39	26	38	50	31	0
air_cond.	0	12	37	28	29	6	10	0	0	0	0	0	0	0
spec.seat	0	25	17	17	0	0	0	0	0	0	0	0	0	0
Total	0	37	54	45	59	11	52	0	39	26	44	50	31	59
TOTAL														
common	0	0	0	0	33	26	90	60	49	149	94	172	200	210
express	35	24	19	120	100	104	205	157	206	102	198	171	155	16
air_cond.	0	76	93	92	129	31	67	50	120	4	0	21	39	0
spec.seat	21	84	53	17	0	0	2	24	6	0	0	0	0	0
G.TOTAL	56	184	165	229	262	161	364	291	381	255	292	364	394	226

TOTAL in 1992								
common	0		59		199		415	410
express	78		324		568		471	171
air_cond.	169		252		237		25	39
spec.seat	158		17		32		0	0
G.TOTAL	405		652		1036		911	620

TOTAL	common	1083
	express	1612
	air-cond.	722
	spec.seat	207
	G.TOTAL	3624

Source: From bus companies (January,1993)

Generally the bus age limit is considered around 10-15 years maximum. Certainly there are buses used more than this limit, but they would encounter much mechanical troubles, and body and interior facilities would have inevitable corrosion and rust. These give much risk in accidents and discomfort to passengers.

The time will come in a few years future when those old aged buses in more than 9 year old need be depleted because of less efficiency. The bus companies should replace those buses in addition to add some buses in order to meet the growth of demand, which would increase by 5-6% per annum in the future.

As in Table 16-3-1, the average bus-km increased from 77,000 to 100,000km during 1982/83--1990/91. The increase was caused by service growth of air conditioned and special seat buses. However, the average running distance per year of 100,000 km of the whole buses would be the maximum level of operations, which cannot be increased substantially more because routine operation hours are mostly in daytime and the size of the licensed area can not expand widely in addition to physical use constraints. If operational efficiencies are assumed to not change in the coming years, the fleet will increase at the same ratio of passenger demand, 5.8% per annum in average. The composition changes of the service classes will be modest, because they have to maintain operation of common and express service classes to fulfill the minimum social service requirements even though their revenue performances are less than the AC and special classes.

In the interviewing with senior staff of the bus companies, they insisted that a minor increase from the current share of AC & special buses would happen in the future. It is supposed the share will change from 26% of 1992 to 35% by the year 2012 of these high priced classes.

In order to forecast the fleet requirement of the companies, the fleet ages are grouped by 3 years and by class as summarized in Table 16-3-4. There were 620 buses with service years more than 12 years out of 3,624 buses in 1992. They can be rebuilt (this mean not only engine overhaul and shaft grinding, but also major body repair works) and used for several years more as practiced by the bus companies. Even with this kind of major repair works, they are likely to be depleted in the coming 3 years up to 1995 and be replaced by new ones. On the other hand, additional 667 buses are necessary to respond the increasing demand. The total will be 4,291 in 1995 after the purchase of addition and replacement of 1,287 buses. In the same manner the period 1996-1998 will add 789 buses together with the replacement of the old 911 buses. The total purchase would be 789+911=1,700. The estimate is repeated for every 3 years up to 2012. These are in Table 16-3-5.

Table 16-3-5 Bus Fleet in the Future, 1992 - 2012

Description	-1992	-1995	-1998	-2001	-2004	-2007	-2010	-2012	(2012)
A Total Bus Fleet in Future (1992 - 2012)									
Common	1083	1257	1458	1690	1959	2268	2626	2941	26.3%
Express	1612	1867	2159	2497	2892	3348	3861	4324	38.7%
AC/Spe.seats	929	1167	1463	1829	2272	2817	3495	3918	35.0%
Total	3624	4291	5080	6016	7123	8433	9982	11183	100.0%
B Bus Additon in Evry 3 years									
Common		174	201	232	269	309	358	315	1858
Express		255	292	338	395	456	513	463	2712
AC/Spe.seats		238	296	366	443	545	678	423	2989
Total		667	789	936	1107	1310	1549	1201	7559
C Additional and Replacement Buses in Evry 3 years									
Common		584	616	431	328	309	532	449	3249
Express		426	763	906	719	534	768	658	4774
AC/Spe.seats		277	321	635	712	872	916	620	4353
Total		1287	1700	1972	1759	1715	2216	1727	12376

Notes: A:buses are estimated to increase with the demand under the current operation efficiency
C: Assuming buses will be replaced after 15 years (B)

Description	1993-'97	1998-2002	2003-'12	Total
D Additional and Replacement Buses in 3 Phases				
Common	995	746	1509	3249
Express	935	1400	2439	4774
AC/Spe.seats	491	979	2883	4353
Total	2420	3125	6831	12376
E with Assumed Increases in Operation Efficiency				
Common	945	671	1207	2823
Express	888	1260	1951	4099
AC/Spe.seats	466	881	2306	3653
Total	2299	2812	5464	10575

Notes: Assuming the bus operation efficiency is increased by 5 % in in every 5 years, as in average occupants or in the revenue related running km., the vehicle fleet can be a little reduced.

There will be a number of factors which influence this fleet renewal/increase tendency. If operational efficiency is increased by 5% in every 5 years, through larger occupants or higher travel speed, etc., the number of buses estimated for procurement in D will be reduced slightly to those in E of the same table.

If the unit price of a bus in those classes is assumed as in Table 16-3-6, the fund for purchasing the buses in each phase can be tabulated in the table. In average 172.8 M.LE is necessary every year.

Table 16-3-6 Bus Fleet Purchase Cost in 3 Phases

(In 1992 prices'000)

Bus type	Unit cost	Phase 1 1993-97	Phase 2 1998-02	Phase 3 2003-12	Total 1993-12
Common	240	226,800	161,040	289,680	677,520
Express	288	255,744	362,880	561,888	1,180,512
Air Co.	350	122,150	231,350	605,150	958,650
Spe.seats	700	81,900	154,000	403,900	639,800
Total		686,594	909,270	1,860,618	3,456,482

Currently the four bus companies have been in the process of privatization under the jurisdiction of Inland Transport Holding Company, and are difficult in getting loans from National Industrial Bank or other governmental funding agencies as it had been before. Rather they need to look for new funding sources partly or entirely in private sector, as well as accumulate depreciation allocation by themselves.

It is recommended that these bus companies should secure new funding methods at the earliest time and at the same time improve their financial positions by various management efforts. These efforts will support the restoration of a balanced fleet age distribution once they had a decade ago.