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والنقل البحرى

MINISTRY OF TRANSPORT AND COMMUNICATION
AND MARINE TRANSPORT

هيئة الطرق والكبارى

ROADS AND BRIDGES AUTHORITY

دراسة الجدوى لمشروع طريق القاهرة - أسيوط

CAIRO-ASSUIT HIGHWAY FEASIBILITY STUDY

FINAL REPORT

Appendix Volume 5

SOCIO-ECONOMIC BASE

بواسطة
ويلبر سميث وشركاه
المجموعة الإستشارية المصرية
القاهرة - جمهورية مصر العربية

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FORWARD

This volume of appendices to the Final Report describes the socio-economic studies which underlay the traffic forecasting and evaluation stages of the Study. The main subjects covered include population, the National economy and economic growth, and vehicle operating costs.

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ECONOMIC PARAMETERS

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Appendix 5A

ECONOMIC PARAMETERS

Project appraisal methodology required the use of various factors to adjust computed or estimated values for either the passage of time or irregularities in the market pricing system. Such factors or parameters were required for both financial and economic evaluations.

Inflation

As inflation could be expected to affect all sectors equally, it was disregarded in the Study forecasts. Therefore all economic and financial values for the Study were in terms of constant 1985/86 LE.

However, it was noted that the Egyptian economy was subject to severe inflationary pressures. Prices were controlled for essential commodities and for many services within the non-tradables sector (housing, utilities, transport). Thus, official estimates of inflation rates (in the range of 10-20 percent per year during the period 1978-1984) based on these controlled prices understated actual inflationary pressures, which were estimated to be in excess of 20% per year. This had an impact on the Study process in that it was sometimes difficult to establish current prices and rates with any security, and comparisons with previous years were obscured.

Discount Rate

In the economic evaluation, future streams of benefits and costs were discounted to the base year using an estimate of the opportunity cost of capital within Egypt. Little or no research was available on either the macro or micro productivity of capital in Egypt for guidance on an appropriate discount rate to use. Phases II and III of the Egypt National Transport Study (ENTS) (Reference 1) used a rate of 12 percent and therefore the same rate of 12 percent was adopted by this Study.

Interest Rate

The statutory ceiling on interest rates was rescinded in 1975 and the Central Bank was empowered to fix interest rates. The 1986 Central Bank discount rate reached 13% with five year commercial loans to the private sector in the neighborhood of 15-16 percent. Concessionary rates were applicable to organizations and companies in the public sector, ranging from 7-9 percent. For financial calculations within the transport sector relating to tariffs and perceived costs of vehicle operations, a uniform commercial rate of 12 percent was adopted for this Study.

Commercial interest rates include an element to cover inflation. It was proper to include this inflationary element in the estimation of tariffs and perceived vehicle operating costs, since inflation does influence tariff setting and the perception of costs. However in one special case, the evaluation of tolls, the inflation element had to be removed. For the analysis of tolls, therefore, a "pure" financial

interest rate of 4% was adopted for use by the Study, which posited an inflation-free economy with the market rate of interest of 4 percent.

Shadow Pricing

Shadow pricing techniques eliminate subsidies and transfer payments, both direct and indirect, and correct for market discontinuities. In a perfect market, the shadow price coincides with the equilibrium market price and represents the economic cost of resources. The Egyptian economy was regulated. Hence, market prices did not adequately reflect resource costs and corrections were necessary for those cases relevant to transport planning. Four cases required particular attention: foreign exchange, petroleum prices, labor costs and the value of time. A comment is also made on the adjustment of economic resource costs for taxes.

Foreign Exchange - In 1986, the Egyptian economy exhibited strong tendencies toward balance of payments deterioration. The 1985/86 situation in regard to the international petroleum market, tourism, and remittances from Egyptian nationals working abroad suggested that futher adjustments in the value of the Egyptian pound could be required. For practical purposes, all foreign exchange transactions were conducted at the parallel rate since 1978. Parallel market exchange rates set by the Central Bank moved as follows:

1973	US$1. = LE 0.39
1975	US$1. = LE 0.64
1976	US$1. = LE 0.66
1977	US$1. = LE 0.70
1978	US$1. = LE 0.80
1985/86	US$1. = LE 1.35

Continuing pressure on the Egyptian pound is expressed in the "own exchange" and "black" markets which were in the neighborhood of US$1.00 = LE 2.00 during 1985/86. A rate of US$1.00 = LE 1.80 was adopted for economic evaluations in this Study. This compares with a rate of US$1.00 = LE 1.20 used by ENTS.

Petroleum - By mid-February 1986, the price for crude oil had dropped below US$ 15.00 per barrel and the average per barrel value of products processed from crude was in the neighborhood of US$ 19.00, compared to US$ 32.00 per barrel in late November 1985. Expert opinion suggested an equilibrium price of US$ 15.00 - 20.00 per barrel. A shadow price of US$ 20.00 per barrel was selected for application in the economic analyses portion of this study. This price was an estimate of the long run equilibrium value of petroleum.

Labor - No further information on the Egyptian labor market situation was available since the completion of the ENTS Phase III (1984). Therefore, the shadow wage rate set forth in that study was maintained at 0.5 for unskilled labor and 1.0 for skilled labor.

Value of Time - Savings in time attributable to the new or improved facility were calculated for both cargo and passengers. For cargo a weighted mixed cargo was derived for each truck type and a per ton value estimated based on the roadside interview and truck weighing surveys. Benefits which might result from inventory cost savings were estimated using the appropriate interest rate for financial and economic evaluations.

Passenger time value is a function of trip purpose and the wage rate. In general, business trips are normally valued at 100 percent of the wage rate while work related and other trips are valued in the neighborhood of 60 percent and 30 percent of the average wage rate respectively.

The following estimates of wage rates were used by this Study in the calculation of time for the estimation of the passenger and cargo time savings:

Wage per hour:	
Professional / Managerial	3.50 LE
Clerical	1.15 LE
Skilled	1.10 LE
Semi skilled	0.40 LE
Agriculture/unskilled	0.10 LE
Assumed wage per hour for passengers by vehicle type	
Private car	1.90 LE
Pickup	1.10 LE
Taxi	0.90 LE
Bus	0.25 LE
Value of Time by Trip Purpose	
Work and Work Related	75% of passenger wage rate
Other	30% " " " "
Cargo Value per Ton	
Pick up	390 LE
Single Truck	340 LE
Combination Truck	350 LE
Articulated Truck	315 LE

Correction for Taxes - The economic evaluation is concerned with the opportunity cost of resources which, therefore, should be valued at the market value in alternative uses. Since most goods are taxed, the strict valuation in economic resource cost terms should be the market price (financial cost), less the tax on that item, plus the average tax on goods and services applying in the community, subsidies counting as a negative tax. However, no estimates were found of the general level of taxation/subsidies in Egypt as a whole, and it was assumed for the purposes of evaluation that taxes and subsidies cancelled out i.e. after deducting the specific taxes on each item, no further adjustment was made to add the average tax/subsidy. This is a somewhat theoretical point which mainly affects the valuation of generated travel benefits (See Appendix 7A), and no great error was made in ignoring this final adjustment.

Appendix 5B

POPULATION STUDIES

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Appendix 5B

POPULATION STUDIES

Introduction

Previous studies, in particular the Egyptian National Transport Study (ENTS), Phases II and III (Reference 1), have commented on the availability, reliability and comparability of Egyptian economic and demographic data. This Study recognized that there were inadequacies in the data base and took steps to make adjustments to provide better comparability and reliability. It was felt that the data were sufficiently accurate to support projections suitable for traffic forecasting.

To minimize comparability errors attributable to numerous administrative changes in boundaries over the last thirty years, the statistical enumeration units were reconfigured to be consistent with those of the last census (1976). The failure of some recent studies to recognize the need for such adjustments produced projections of urbanization ratios which were too high. Thus urbanization ratios of the current study were slightly lower than some other studies, but they were considered to be more reliable. Furthermore, lower urbanization ratios provided a conservative basis for testing feasibility, since they resulted in lower transport demand and required higher benefits to prove their feasibility.

Population Studies

Egypt is one of the most ancient inhabited areas in the World with a civilization going back 5000 years. It exemplifies a typical densely inhabited developing country with a high population growth and limited economic resources.

It is doubtful whether national population ever exceeded 10 million prior to 1900. Examination of total population figures in census years showed an increase from about 10 million in 1897 to about 38 million in 1976. Thus the 28 million added to Egypt's population during 80 years amounted, approximately, to a threefold increase over Egypt's population accumulated throughout the long historical period prior to 1897. This high rate of population growth is officially recognized as a major national problem increasing the difficulty of resolving other social and economic problems due to the limited potential of the inhabitable areas and other resources.

National Growth

As delineated in Table 5B.1 the annual growth rate of the Egyptian population declined from 1.48 percent during the period 1897-1907 to 1.10 percent during the period 1917-1927. The rate thereafter increased, attaining a level of 2.53 percent during the period 1960-1966. The latest census (1976) recorded a decrease to an annual rate of 2.31 percent, or

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Table 5B-1

POPULATION TOTALS AND GROWTH RATES 1897-1976

CENSUS YEARS	POPULATION IN THOUSANDS(1)		ANNUAL RATE OF GROWTH FOR INTERVENING PERIODS(4)	
1897	9,749		-	
1907	11,287		1.48	
1917	12,751		1.23	
1927	14,218		1.10	
1937	15,933		1.15	
1947	19,022		1.79	
1960	26,085		2.37	
1966	30,076	(2)	2.53	
1976	38,198	(36773)(3)	2.31	(1.93)

SOURCE: CAPMAS, Egyptian Censuses conducted during each of the assigned years.

Notes

(1) Nomadic population are included.

(2) 1966 Census figures used in this Study are based on complete count of population, but other census population characteristics are of sample base

(3) 1976 population includes estimates of Egyptians living abroad(1.425 million) and living in occupied land (147,000 persons), but figures in parentheses discount Egyptians abroad.

(4) Exponential function is utilized in calculations. Intercensal periods are 10 years for all periods prior 1947, 13.5 years for 1947-1960, 5.7 years for 1960-1966, and 10.5 for 1966-1976 period.

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1.96 percent if Egyptians abroad are excluded. Wars and depressed socio-economic conditions probably contributed to this recent decline.

Vital Statistics

As presented in Table 5B-2, prior to 1961 crude birth rates were at a moderately high level of 42 births per thousand population with temporary declines following wars, epidemics and economic depressions. After 1961, the rate declined to a low of 34.3 in 1972 then increasing to reach a level of 39.8 in 1979. The 1982 rate was officially estimated at 41.8 per thousand. This high level was thought to be temporary, resembling a "baby boom" post-war or post-economic depression phenomenon. The steadily declining death rate coupled with a fairly high but fluctuating birth rate resulted in a high rate of natural population increase, 2.0-2.7 percent 1960-1979. The latest official estimates showed an annual natural increase rate of about 2.9 percent.

The governorates within the Cairo-Assuit highway corridor(Giza, Beni Suef, Fayoum, Minia and Assuit) displayed similar trends to the corresponding national level rates but with less stability. Due to the incomplete and erratic nature of data plus the impact of internal migration, vital statistics at the governorate level appeared unsuitable for determining the future population prospects in the Cairo-Assuit corridor.

External Migration

Until recent years, international migration did not constitute an important element in Egypt's population increase. According to the 1976 census, Egyptians residing abroad were estimated at 1.425 million, or 3.7 percent of the total population. However, an official estimate of 1.828 million Egyptians abroad was announced in 1985. Such a volume of emigrants confirmed that external migration had to be a factor in forecasting population at the national level.

Regional Growth

The Egyptian population in 1976 was reported by 25 governorates and grouped by the four traditional statistical categories, urban governorates, frontier governorates, Lower Egypt and Upper Egypt. Population size and annual rates of growth in each of the 25 governorates over the last 30 years are presented in Table 5B.3.

Table 5B-3 indicates that higher rates of growth were experienced where "urban primacy" exists; that is to say, in Greater Cairo (Cairo, Giza and Kalyubia Governorates), Alexandria and the Suez Canal governorates (Port Said, Suez and Ismailia). War conditions were responsible for the observed discontinuities in growth for the Suez Canal Governorates. Higher population growth was also indicated in conjunction with land reclamation projects in Lower Egypt (Damietta, Behera, Sharkia and Kafr El Shiekh) and with short term developments in Aswan. The absorption capacity of the other governorates, especially those of Upper Egypt, appeared to be less than the natural rates of population increase and they have always been the source of out-migration to other parts of Egypt.

Table 5B-2

BIRTH, DEATH AND NATURAL INCREASE RATES BY GOVERNORATE: 1960-1979

YEAR	ASSUIT			GIZA			BENI SUEF			FAYOUM			MINIA			ALL EGYPT		
	Birth	Death	Incr	Birth	Death	Incr	Birth	Death	Incr	Birth	Death	Incr	Birth	Death	Incr	Birth	Death	Incr
1960	45.2	14.7	30.5	37.2	20.0	17.2	42.7	18.6	24.1	41.5	18.4	23.1	41.7	14.1	27.8	34.1	16.9	26.2
1961	44.9	18.6	26.3	40.7	15.3	25.4	45.2	17.7	27.5	42.3	17.1	25.2	42.8	16.6	26.2	44.1	15.8	28.3
1962	44.1	21.1	23.0	38.0	20.7	17.3	42.8	22.9	19.9	38.6	21.5	17.1	36.3	20.9	15.4	41.5	17.9	23.6
1963	37.3	19.4	17.9	40.2	20.3	19.9	45.3	19.2	26.1	40.0	20.6	19.4	40.7	18.6	22.1	43.0	15.5	27.5
1964	47.0	19.4	27.6	42.8	20.3	22.5	44.6	20.7	23.9	42.5	19.5	23.0	41.3	18.6	22.7	42.3	15.7	26.6
1965	46.8	17.2	29.6	42.9	16.5	26.4	43.8	17.5	26.3	40.3	17.1	23.1	38.4	17.3	21.1	41.7	14.1	27.6
1966	45.6	18.6	27.0	44.8	19.4	25.4	44.8	20.9	23.9	42.9	17.7	25.2	41.7	18.0	23.7	41.2	15.9	25.3
1967	42.7	15.3	27.4	45.5	19.3	26.2	43.7	17.9	25.8	42.2	17.5	24.7	41.8	17.0	24.8	38.9	14.2	24.7
1968	44.7	19.7	24.0	43.4	19.4	24.0	42.4	18.8	23.6	43.2	19.7	23.5	41.6	18.3	23.3	37.9	16.0	21.9
1969	43.5	15.9	27.6	43.6	20.2	23.4	41.5	17.5	24.0	41.0	18.5	22.5	38.4	16.7	21.7	36.8	14.4	22.4
1970	41.8	18.5	23.3	41.2	20.6	20.6	40.2	18.7	21.5	38.9	19.6	19.3	36.9	17.1	19.8	35.0	15.1	19.9
1971	42.9	15.2	27.7	40.1	17.5	22.6	39.3	16.4	22.9	37.9	17.2	20.7	36.1	14.7	21.4	35.0	13.1	21.9
1972	41.6	17.3	24.3	38.6	19.1	19.5	38.3	18.0	20.8	37.3	18.6	18.7	36.5	15.8	20.7	34.3	14.4	19.9
1973	45.0	14.6	30.4	40.2	17.0	23.2	41.4	15.1	26.3	38.6	16.1	22.5	39.0	15.3	23.7	35.7	13.0	22.7
1974	46.0	15.0	31.0	39.4	15.5	23.9	39.6	16.5	23.1	37.3	15.5	21.8	37.4	13.8	23.6	35.6	12.6	23.0
1975	46.5	14.0	32.5	39.1	15.0	24.1	41.0	13.2	27.8	37.5	13.7	23.8	38.6	12.3	26.3	36.0	12.1	23.9
1976	46.8	13.8	33.0	39.1	14.3	24.8	40.1	14.7	25.4	39.3	13.9	25.4	35.5	12.2	23.3	36.4	11.7	24.7
1977	43.8	13.0	30.8	42.6	14.9	27.7	42.8	13.7	29.1	42.1	14.7	27.4	39.5	12.8	26.7	36.4	11.8	25.5
1978	45.3	10.9	32.4	43.1	12.2	30.9	43.2	11.6	31.6	42.0	12.5	29.5	40.0	11.4	28.6	36.3	10.4	27.0
1979	45.6	11.6	34.0	42.7	14.6	28.1	44.4	12.6	31.8	42.4	12.8	29.6	40.7	12.4	28.3	39.8	10.8	29.0

Source: CAPMAS; Annual reports on Vital Statistics

Note: Births, deaths, and the difference between them during each year are divided by population at mid-year, in thousands, to calculate the rates of birth, death and natural increase respectively (as reported in this table).

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Table 5B-3

POPULATION SIZE AND GROWTH RATES, 1947-1976

GOVERNORATE	POPULATION AT CENSUS				GROWTH RATES (1)		
	1947	1960	1966	1976	47/60	60/66	66/76
	(thousands)				(percent per year)		
Urban Governorates							
Cairo	2082	3360	4232	5074	3.61	4.13	1.74
Alexandria	961	1531	1818	2318	3.51	3.06	2.34
Port Said	165	252	291	263	3.19	2.56	-0.96
Suez	110	206	264	194	4.76	4.45	-2.89
Total	3318	5349	6605	7849	3.60	3.77	1.66
Lower Egypt							
Damiette	265	393	445	576	2.96	2.20	2.49
Dakahlia	1443	2000	2261	2737	2.45	2.18	1.84
Sharkia	1362	1831	2119	2618	2.22	2.60	2.03
Kalyubia	736	1016	1205	1681	2.42	3.04	3.22
Kafr El-Shiekh	683	973	1119	1407	2.66	2.48	2.21
Gharbia	1264	1675	1901	2293	2.11	2.25	1.80
Menofia	1136	1355	1458	1711	1.31	1.29	1.54
Behera	1219	1693	1989	2464	2.46	2.87	2.06
Ismailia	177	278	337	354	3.40	3.43	0.47
Total	8285	11214	12834	15841	2.27	2.40	2.02
Upper Egypt							
Giza	848	1336	1655	2417	3.42	3.83	3.67
Beni-Suef	727	860	928	1110	1.25	1.34	1.72
Fayoum	670	839	935	1142	1.68	1.92	1.92
Minia	1268	1560	1706	2054	1.55	1.58	1.78
Assuit	1030	1323	1418	1697	1.87	1.22	1.73
Suhag	1289	1585	1689	1925	1.54	1.12	1.25
Qena	1106	1351	1471	1709	1.49	1.50	1.44
Aswan	291	386	521	619	2.11	5.40	1.66
Total	7229	9240	10323	12673	1.83	1.96	1.97
Frontier Gov.(2)							
Red Sea	24	31	37	55	1.91	3.15	3.85
New Valley	41	41	60	85	0.00	6.91	3.37
Matrouh	64	84	86	113	2.03	0.41	2.63
Sinai	61	126	131	157	5.52	0.69	1.74
Total	190	282	314	410	2.97	1.90	2.57
Total Egypt	19022	26085	30076	36773	2.37	2.53	1.93

SOURCE: Compiled and adjusted for intergovernorate changes in boundaries from Egyptian censuses, CAPMAS.

Notes: (1) Exponential function was used in calculations.
(2) Figures prior to 1966 for all governorates were estimated, also for Sinai in 1976.

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Regional Distribution

Table 5B-4 delineates regional distribution of population for the governorates over the last 30 years. This table confirms the above observation that Upper Egypt has been the source of out-migration. While the percentage share of Lower Egypt remained relatively stable at around 43.3 percent, between 1947 and 1976, that of Upper Egypt decreased from 38.0 to 34.5 percent. If Giza Governorate, whic was really a part ofwhich was really a part of Greater Cairo, is excluded from Upper Egypt, then Upper Egypt's share of population decreased significantly from 33.5 percent to 27.9 percent during the 1947-1976 period. This population shift was directed toward the four urban governorates whose population share increased from 17.4 percent to 22.0 percent between 1947 and 1966. From 1966 to 1976, the urban governorates' share decreased due to war conditions in the Suez zone and due to lower rates of increase for Cairo and Alexandria.

Comparability of Data

The urban population in Egypt was officially defined according to administrative criteria in 1960 as that population within the four urban governorates, the capitals of the provincial governorates, and the capitals of the districts (Markez) within these governorates. In addition to these administratively defined urban units, a few other areas were given urban status. According to such criteria, many settlements formally defined as urban had predominantly rural economic and sociologic characteristics. Similarly, some settlements that were statistically classified as rural surpassed many urban settlements in size and other urban characteristics.

Administrative borders within Egypt have been altered for several reasons during the last 40 years, including the creation of three new governorates and many districts. The capitals of these new districts, nominally villages, were reclassified as towns. The total number of Egyptian cities and towns increased from 96 to 160 betwen 1947 and 1976. Also, urban settlements experienced numerous boundary changes, including rural settlements frequently being annexed to existing towns, and parts of some towns being detached and incorporated within rural settlements.

Unless adjusted for consistency, these boundary changes lead to comparability errors in defining urban versus rural population. A careful examination of various reference studies was carried out as a part of this project. It was noted that failure to adjust properly for comparability errors appears to have resulted in overestimation of urban population and inflated projections of urbanization. For transport planning purposes, an accurate projection of urban versus rural population concentrations was critical because the interchange of trips among urban centers and the distinction in travel patterns between urban and rural areas were important factors in making reliable projections of future travel demands.

Table 5B-4

POPULATION DISTRIBUTION, 1947-1976
(Percent of National Total)

GOVERNORATE	1947			1960			1966			1976		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Urban Governorates												
1. Cairo	30.46		10.94	31.78		12.88	32.88		14.07	31.36		13.80
2. Alexandria	14.06		5.05	14.48		5.87	14.12		6.04	14.33		6.30
3. Port Said	2.42		0.87	2.38		0.97	2.26		0.97	1.63		0.72
4. Suez	1.61		0.58	1.95		0.79	2.05		0.88	1.20		0.53
TOTAL	48.55	0.00	17.44	50.59	0.00	20.51	51.31	0.00	21.96	48.52	0.00	21.35
Lower Egypt												
1. Damietta	1.16	1.53	1.39	0.92	1.91	1.51	0.99	1.85	1.48	1.08	0.87	1.57
2. Dakahlia	4.65	9.23	7.59	4.13	10.08	7.67	3.86	10.25	7.52	0.88	2.10	7.44
2. Sharkia	2.90	9.55	7.16	3.15	9.66	7.02	3.31	9.84	7.05	4.06	10.10	7.12
4. Kalyubia	2.53	4.62	3.87	2.77	4.66	3.89	3.10	4.68	4.00	3.28	10.14	4.57
5. Kafr El Sheikh	1.97	4.50	3.59	1.80	5.05	3.73	1.66	5.27	3.72	4.23	4.84	3.83
6. Gharbia	5.19	7.46	6.64	4.96	7.41	6.42	4.71	7.53	6.32	1.80	5.42	6.24
7. Menufia	2.87	7.71	5.97	2.37	7.12	5.19	2.15	6.86	4.85	4.72	7.43	4.65
8. Beheria	4.02	7.74	6.41	3.91	8.25	6.49	3.75	8.75	6.61	2.08	6.67	6.70
9. Ismailia	1.38	0.68	0.93	1.39	0.84	1.07	1.41	0.91	1.12	3.68	9.08	0.96
TOTAL	26.67	53.02	43.55	25.40	54.98	42.99	24.94	55.94	42.67	25.81	56.65	43.08
Upper Egypt												
1. Giza	4.42	4.48	4.46	6.03	4.50	5.12	6.77	4.56	5.50	8.62	4.96	6.57
2. Beni Suef	2.21	4.73	3.82	1.86	4.27	3.30	1.70	4.12	3.09	1.71	4.05	3.02
3. Fayoum	2.11	4.32	3.52	1.83	4.17	3.22	1.73	4.14	3.11	1.71	4.21	3.11
4. Minia	3.25	8.58	6.67	2.88	8.09	5.98	2.67	7.92	5.67	2.66	7.88	5.59
5. Assuit	3.54	6.47	5.41	3.14	6.39	5.07	2.91	6.06	4.71	2.91	5.96	4.62
6. Sohag	3.61	8.55	6.78	2.96	8.20	6.07	2.61	7.87	5.62	2.53	7.36	5.24
7. Qena	3.42	7.15	5.81	2.70	6.87	5.18	2.46	6.71	4.89	2.42	6.40	4.65
8. Aswan	0.92	1.87	1.53	0.95	1.84	1.48	1.41	1.97	1.73	1.45	1.86	1.68
TOTAL	23.48	46.15	38.00	22.35	44.33	35.42	22.26	43.35	34.32	24.01	42.68	34.48
Frontier Governorates												
1. Red Sea	0.31	0.03	0.13	0.25	0.03	0.12	0.24	0.03	0.12	0.30	0.03	0.15
2. New Valley	0.13	0.26	0.21	0.12	0.18	0.16	0.16	0.23	0.20	0.22	0.24	0.23
3. Matrouh	0.10	0.47	0.34	0.23	0.39	0.32	0.20	0.36	0.29	0.32	0.30	0.31
4. Sinai	0.76	0.07	0.32	1.06	0.09	0.48	0.89	0.09	0.44	0.82	0.10	0.41
TOTAL	1.30	0.83	1.00	1.66	0.69	1.08	1.49	0.71	1.05	1.66	0.67	1.10
TOTAL EGYPT	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Calculated from Tables 3.3 and 3.5

Urban-rural population differences were important not only in describing travel patterns and trip characteristics, but also in projection of socio-economic parameters. In this Study, a United Nations developed model utilizing urban-rural growth differences was applied to obtain projected population distribution.

For this Study, therefore, a detailed review was made of the results of the last four censuses, and all data were adjusted to the 1976 enumeration boundaries before analyzing trends in rural and urban population. The results of this review are summarised in Table 5B-5. While the results do represent some departure from former demographic analyses, it is felt that the data obtained by these adjustments represent a necessary refinement in order to make reliable travel demand projections.

Urbanization Trends

As measured by the percent of the population living in urban areas, the level of urbanization in Egypt increased by 8.1 percent in 30 years, from 35.9 percent in 1947 to 44.0 percent in 1976. The pace of urbanization was rapid until 1966, but then decelerated during the period 1966-1976. The level of urbanization in Upper Egypt and Lower Egypt was almost equal in 1947 at 22.0 percent, but thereafter increased in both. A faster pace of urbanization was seen in Upper Egypt, with the urban population reaching 30.7 percent of the total in 1976, compared with 26.4 percent in Lower Egypt. However, the faster pace in Upper Egypt was attributable to the effect of the growing urban population in Giza governorate associated with the Greater Cairo Conurbation. With Giza Governorate excluded from the Upper Egypt figures, the proportion of urban population in Upper Egypt decreases to 20.4 percent and 24.3 percent in 1947 and 1976 respectively.

The data for individual non-urban governorates in Lower and Upper Egypt show that only two (Giza, and Ismailia) attained the national average of percent urban. Menoufia and Sohag ranked high among those governorates exporting population and were the least urbanized, with only 19.7 and 21.3 percent of their population in urban areas in 1976. On the other hand, Kalyubia, Ismailia, and Giza attained relatively higher levels of percent urban in 1976 (40.7, 49.2, and 57.7 percent respectively). Aswan and Gharbiah had also attained moderate levels of urbanization in 1976 with 38.0 and 33.3 percent urban respectively.

Within the Cairo-Assuit Corridor, Assuit governorate was relatively more urbanized in 1976 (27.7 percent urban); Minia governorate was least urbanized (21.0 percent); while Fayoum and Beni Suef governorate were moderately urbanized (24.9 and 24.2 percent urban respectively).

Urban and Rural Growth Rates

Growth rates in urban and rural population are shown in Table 5B-6. In general the annual growth rates show that Egypt's urban population increased at a significantly higher rate than that of the country as a whole, while the rural population rate of growth remained less than that

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Table 5B-5

URBAN AND RURAL POPULATION: 1947-1976
(thousands)

GOVERNORATE	1947 Urban	1947 Rural	1960 Urban	1960 Rural	1966 Urban	1966 Rural	1976 Urban	1976 Rural	URBAN POPULATION AS PERCENTAGE OF TOTAL 1947	1960	1966	1976
Urban Governorates												
1. Cairo	2,082		3,360		4,232		5,074		100.0	100.0	100.0	100.0
2. Alexandria	961		1,531		1,818		2,318		100.0	100.0	100.0	100.0
3. Port Said	165		252		291		263		100.0	100.0	100.0	100.0
4. Suez	110		206		264		194		100.0	100.0	100.0	100.0
TOTAL	3,318	0	5,349	0	6,605	0	7,849	0	100.0	100.0	100.0	100.0
Lower Egypt												
1. Damietta	79	186	97	296	127	318	143	433	29.8	24.7	28.5	24.8
2. Dakahlia	318	1,125	437	1,563	497	1,764	657	2,080	22.0	21.9	22.0	24.0
2. Sharkia	198	1,164	333	1,498	426	1,693	530	2,088	14.5	18.2	20.1	20.2
4. Kalyubia	173	563	293	723	399	806	685	996	23.5	28.8	33.1	40.7
5. Kafr El Sheikh	135	548	190	783	213	906	292	1,115	19.8	19.5	19.0	20.8
6. Gharbia	355	909	525	1,150	606	1,295	764	1,529	28.1	31.3	31.9	33.3
7. Menufia	196	940	250	1,105	277	1,181	337	1,374	17.3	18.5	19.0	19.7
8. Beheria	275	944	413	1,280	483	1,506	595	1,869	22.6	24.4	24.3	24.1
9. Ismailia	94	83	147	131	182	155	174	180	53.1	52.9	54.0	49.2
TOTAL	1,823	6,462	2,685	8,529	3,210	9,624	4,177	11,664	22.0	23.9	25.0	26.4
Upper Egypt												
1. Giza	302	546	638	698	871	784	1,395	1,022	35.6	47.8	52.6	57.7
2. Beni Suef	151	576	197	663	219	709	276	834	20.8	22.9	23.6	24.9
3. Fayoum	144	526	193	646	222	713	276	866	21.5	23.0	23.7	24.2
4. Minia	222	1,046	305	1,255	344	1,362	431	1,623	17.5	19.6	20.2	21.0
5. Assuit	242	788	332	991	375	1,043	470	1,227	23.5	25.1	26.4	27.7
6. Sohag	247	1,042	313	1,272	336	1,353	410	1,515	19.2	19.7	19.9	21.3
7. Qena	234	872	285	1,066	317	1,154	392	1,317	21.2	21.1	21.5	22.9
8. Aswan	63	228	100	266	182	339	235	384	21.6	25.9	34.9	38.0
TOTAL	1,605	5,624	2,363	6,877	2,866	7,457	3,685	8,788	22.2	25.6	27.8	30.7
Frontier Governorates (1)												
1. Red Sea	21	3	26	5	31	6	48	7	87.5	83.9	83.8	87.3
2. New Valley	9	32	13	28	21	39	35	50	22.0	31.7	35.0	41.2
3. Matrouh	7	57	24	60	25	61	52	61	10.9	28.6	29.1	46.0
4. Sinai	52	9	112	14	115	16	133	20	85.2	88.9	87.8	86.9
TOTAL	89	101	175	107	192	122	268	138	46.8	62.1	61.1	66.0
TOTAL EGYPT	6,835	12,187	10,572	15,513	12,873	17,203	16,179	20,590	35.9	40.5	42.8	44.0

Source: CAPMAS; compiled from census records, with urban classification adjusted by Study (see text)
(1) Pre-1966 data and Sinai 1976 data estimated.

Table 5B-6

URBAN AND RURAL POPULATION GROWTH, 1947-1976

GOVERNORATE	1947/1960		1960/1966		1966/1976		1960/1976	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
	(percent growth per year)							
Urban Gov.								
Cairo	3.61		4.13		1.74		2.58	
Alexandria	3.51		3.06		2.34		2.59	
Port Said	3.19		2.56		-0.96		0.26	
Suez	4.76		4.45		-2.89		-0.37	
Total	3.60		3.77		1.66		2.40	
Lower Egypt								
Damietta	1.53	3.50	4.84	1.27	1.14	2.98	2.42	2.38
Dakahlia	2.38	2.47	2.28	2.45	2.69	1.58	2.55	1.78
Sharkia	3.93	1.89	4.42	2.17	2.10	2.02	2.91	2.07
Kalyubia	3.98	1.87	5.57	1.92	5.28	2.04	5.38	2.00
Kafr El-Shiekh	2.56	2.68	2.02	2.59	3.05	2.00	2.69	2.21
Gharbia	2.94	1.76	2.55	2.11	2.23	1.59	2.34	1.77
Menofia	1.82	1.21	1.82	1.17	1.88	1.45	1.86	1.35
Behera	3.06	2.28	2.78	2.89	2.01	2.08	2.28	2.36
Ismailia	3.37	3.44	3.82	3.00	-0.43	1.43	1.05	1.98
Total	2.91	2.08	3.18	2.14	2.54	1.85	2.77	1.95
Upper Egypt								
Giza	5.70	1.84	5.61	2.06	4.59	3.67	4.95	2.38
Beni-Suef	1.99	1.05	1.87	1.18	2.23	1.56	2.10	1.43
Fayoum	2.19	1.53	2.49	1.75	2.10	1.87	2.23	1.83
Minia	2.38	1.36	2.13	1.45	2.17	1.68	2.16	1.60
Assuit	2.37	1.71	2.16	0.90	2.17	1.56	2.17	1.33
Suhag	1.77	1.49	1.25	1.09	1.91	1.08	1.68	1.09
Qena	1.47	1.50	1.88	1.40	2.04	1.27	1.99	1.31
Aswan	3.48	1.69	11.08	3.03	2.46	1.19	5.42	1.84
Total	2.91	1.50	3.44	1.43	2.94	1.58	3.12	1.53
Frontier Gov.								
Red Sea	1.59	3.86	3.13	3.25	4.25	1.48	3.86	2.10
New Valley	2.76	0.98	8.78	5.99	4.99	2.39	6.30	3.64
Matrouh	9.56	0.38	0.72	0.29	7.22	0.00	4.89	0.10
Sinai	5.85	3.33	0.46	2.37	1.39	2.15	1.07	2.23
Total	5.14	0.43	1.64	2.33	3.23	1.18	2.67	1.58
Total Egypt	3.28	1.80	3.52	1.83	2.20	1.73	2.66	1.76

SOURCE: Calculated from Table 3.5

Note: Exponential function is used in the calculation of growth rates.

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of total population. The annual population growth rates of all urban areas were 3.28 percent for the period 1947-1960, 3.52 percent for the period 1960-1966, and declined to 2.20 percent during the period 1966-1976. The corresponding rural rates for the same periods were 1.80 percent, 1.83 percent, and 1.73 percent respectively. This suggests a substantial rural-to-urban migration.

The decline in urban growth rates during the last intercensal period were probably attributable to the selective nature of the emigration of urban population, evacuation of Suez-Canal Zone cities because of the war conditions, and acute problems related to over-urbanization in urban areas in general and Cairo governorate in particular. These explained the reduction in the urban governorates' rate of population growth to 1.66 percent during the period 1966-1976, after maintaining a high level of more than 3.60 percent during the previous two intercensal periods.

Coming to provincial governorates, the data in Table 5B-6 show that growth rates were neither even nor constant over time. Until 1960, the annnual rate of urban population growth in Lower Egypt governorates was similar to that of Upper Egypt governorates (1.91 percent). By 1976, because of the significantly higher growth of urban population in Giza and Aswan governorates, Upper Egypt had higher rates of growth than Lower Egypt. The four governorates located in the Cairo-Assuit highway corridor (Fayoum, Beni Suef, Minia, and Assuit) had a moderate rate of urban population growth, fluctuating around 2.0 percent per annum. On the other hand, Kalyubia governorate's high urban population growth appeared to have increasing weight in explaining urban growth in Lower Egypt as a whole. The remarkably higher urban population growth in Giza and Kalyubia governorates were, to a great extent, due to the fast growing portions of the Cairo conurbation being located within the administrative boundaries of these two governorates. The three Suez-Canal zone governorates (Port Said, Suez, and Ismailia) were growing rapidly due to the development potentials available in the area. The lowest urban population growth rates were mainly observed in densely populated governorates such as Menufia in Lower Egypt and Suhag in Upper Egypt.

Summary of Population Factors

The last national census, 1976, reported a total population of 38.2 million or 36.8 million excluding Egyptians living abroad or in occupied lands. Prior to 1947, the annual intercensal rate of growth varied from a low of 1.1 percent (1917-1927) to a high of 1.8 percent (1937-1947). Thereafter, the natural growth rate demonstrates an increasing trend due to a relatively high birth rate and a declining rate of mortality. The latest intercensal period produced an annual increase rate of 2.3 percent. Based on vital statistics, latest estimates of the natural increase rate were of the order of 2.9 percent.

Regional distribution demonstrated urban primacy in that the population share of the Urban Governorates increased from 17.4 to about 22.0 percent during the period 1947 to 1976. During the same period, Lower Egypt's share remained constant at around 43 percent. Upper Egypt was a source of out-migration and its share decreased from 38.0 to 34.5 percent.

After adjusting the data of previous censuses to provide continuity with the 1976 census at the enumeration district level, the urban category increased from 35.9 percent in 1947 to 44.0 percent in 1976. The urbanization trend was rapid until 1966 but decreased during the period 1966-1976.

This Study utilized the United Nations URGD method to forecast urbanization trends. The use of this method, plus a careful and thorough comparability adjustment, yields and urbanization rate lower then previous studies. For the year 2000, the ENTS Phase III urban proportion was 60 percent, the NUPS urban proportion was 54.8 percent and the urban proportion of this study is 50.8 percent. It was felt that the methodology used in the Cairo-Assuit Highway Feasibility Study provided a more reliable basis for projection of travel demands.

Appendix 5C

NATIONAL ECONOMIC BASE

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Appendix 5C

NATIONAL ECONOMIC BASE

This Appendix presents a review and analysis of Egypt's national economic characteristics. Included are discussions of gross domestic product, balance of payments and public finance. Recent developments within the national accounts (for example, the petroleum sector), the balance of payments and public finance indicate the existence of constraints on an accelerated future rate of economic growth.

General

Long term growth of the National gross domestic product was about 5.8 percent annually for the period 1956 to 1985. The 1975-80 period was one of high growth, around 9.3 percent annually. This was funded primarily by a large increase in foreign exchange earnings from the petroleum sector, the Suez Canal, expatriate remittances, tourism and foreign assistance. The rates of growth declined in the 1980's, averaging 6.4 percent for the period 1980-85. By mid 1986, international and domestic events appeared to have ended rapid growth prospects and signalled the beginning of an austerity period for the Egyptian economy.

Sizeable absolute decreases in the petroleum sector, tourism and expatriate remittances were expected, with Suez Canal earnings either stable or showing a modest increase. Other export earnings were not expected to increase significantly, and foreign assistance to replace the entire decrease was thought unlikely. A strategy to reduce the current account balance of payments deficit was required, and a further increase in financing the budget deficit via domestic banking channels was expected to be difficult.

In view of prevailing and forecast economic conditions, the study has adopted a modest annual economic rate of for 1985-1990 of 6 percent, increasing to 6 percent for 1990-2000.

Gross Domestic Product

Historic growth rates of the Egyptian gross domestic product at constant factor costs are displayed in Table 5C-1. During the period 1956-1985, the Egyptian economy grew at an average rate on the order of 5.8 percent per year. The period of low growth, 1966-1971, reflected a multitude of problems: the rate of savings had not increased in line with the rate of investment; military involvement in the Yemen and the Arab-Israeli war of 1967; a heavy defense burden; public sector inefficiencies; and mal-administration of prices, foreign trade and investment.

Economic and political discontinuities occuring during the first half of the 1970-1980 decade permitted a redirection of economic strategy. A new strategy was enunciated by President Anwar El-Sadat in the"October 1973 Working Paper". Policies enacted thereafter, in general attempted to

Table 5C-1

AVERAGE ANNUAL GROWTH RATES
EGYPT GROSS DOMESTIC PRODUCT
(Constant Prices)

YEAR	ANNUAL GROWTH RATE (%)
1956-61	5.3
1961-66	6.1
1966-71	2.9
1971-75	4.7
1975-80	9.3
1980-85	6.4
1956-1985	5.8

Source: Consultant

Note: From 1980 onward, government practice switched from a calendar year to a budget year.

implement the principles and priorities set forth in the paper to modernize Egyptian society by the year 2000 by accelerating economic growth. The planning framework emphasized modernization of industry, intensive high value agriculture, oil and energy development, and tourism while the "outward-looking "economic policy was designed to attract requisite foreign capital and technical assistance. Liberalization policies and encouragement of the private sector were accompanied by a reorientation of the public sector to increase efficiency. Concentrated efforts on basic development projects not attractive to the other sectors and the provision of services to private and foreign investment were enunciated as appropriate public sector objectives. The necessity of balanced social development was stressed with the goal of reducing disparities between the capital and the provinces.

To what extent the above policies affected the rapid economic growth during the last portion of the 70's, in excess of 9 percent, was impossible to ascertain. Exogeneous factors unrelated to productive economic factors undoubtedly played the major role. Large increases in the foreign exchange earnings from expatriate worker remittances and petroleum exports plus significant increases in receipts from tourism, the Suez Canal and foreign assistance encouraged a relatively unrestrained growth of commodity imports and partially alleviated government budgetary deficits.

As illustrated in Table 5C-1, rates of real economic growth decreased during the first half of the 1980's. Various factors (multiple exchange rate accounting, discounting procedure for market prices, 8 percent annual real growth rate goal of the current five year plan) suggested an element of overstatement in the latest gross domestic product estimates. The data presented indicates an annual growth rate of about 6.4 percent for the five years 1980-1985. ENTS Phase III assumed a rate of 8 percent for the period 1982-1987, but economic performance failed to achieve this expectation. The real rate of growth may have been in the neighborhood of 4-5 percent annually during the period 1980-1984.

Gross Domestic Product by Sector

Table 5C-2 shows a breakdown of GDP by sector.

Agriculture - Table 5C-2 indicates an annual rate of increase for the agriculture sector of 3 percent during the decade prior to this Study. An examination of production in metric tons for major crops presented a less optomistic trend within the sector. The ratio of domestic supply to total consumption for cereals, sugar, milk and vegetable oils decreased steadily since 1970. Food imports constituted about 27 percent (by value) of total commodity imports in 1983/84 and comprised an estimated 50 percent of total consumption. Production of cereals (wheat, rice, maize, millet, barley) was stagnant or, as a group, increasing annually at less than one percent. Vegetable production appeared to be on a trend similar to population increase, 2.7 percent. Feddans of fruit showed an annual increase of 4.5 percent with output increasing annually 6.0-7.0 percent. Production of a primary agricultural output, cotton, appeared stable or

Table 5C-2

GROSS DOMESTIC PRODUCT AT CONSTANT FACTOR COST
(LE Millions)

SECTOR	1975	1976	1977	1978	1979	1980	1980	1981	1982	1983	1984	1985	1990	2000
	(Constant 1975 LE)						(Constant 1980/81 LE)							
Agriculture	1,407	1,491	1,490	1,561	1,613	1,661	3,695	3,892	3,886	3,965	4,115			
Industry and Mining	858	927	1,001	1,083	1,180	1,306	2,520	2,715	3,018	3,130	3,582			
Petroleum	156	211	342	378	577	604	2,629	2,945	3,322	3,500	3,715			
Electricity	72	78	86	89	104	115	135	139	144	158	153			
Construction	230	244	274	287	321	403	772	859	935	1,045	1,103			
Sub-total Commodities	2,723	2,951	3,193	3,398	3,795	4,089	9,751	10,550	11,305	11,798	12,668	12,685		
Product Services	961	1,132	1,342	1,410	1,490	1,679	4,766	5,379	5,907	6,289	6,702	7,457		
Social Services	1,095	1,185	1,354	1,424	1,558	1,728	3,689	3,711	3,893	4,073	4,415	4,594		
GROSS DOMESTIC PRODUCT	4,779	5,268	5,889	6,232	6,843	7,496	18,206	19,640	21,105	22,160	23,785	24,736	30,095	53,896

Source: Ministry of Planning, adjusted by consultants using data from the Central Bank of Egypt and the World Bank (IBRD).

Note: (1) From 1980 onwards, Government switched from a calender year to a budget year (mid-year to mid-year). Hence data presented for the period 1980-2000 are as of mid-budget year (December 31).

(2) Owing to the change to budget years, data for 1980, the common year between the two series cannot be compared directly. However, it is evident that discrepancies between the two series are not completely explained by this. This is commented on in the text.

slightly decreasing with cotton exports representing 11.0-12.0 percent of the total value of exports.

Historic annual increase of the agriculture sector, 1950-1984, was estimated at about 2.2 percent. Options to increase agricultural output were both expensive and difficult. Land reclamation has proven to be more costly than estimated and considerably less productive with a development period of about fifteen years. Investment expenditures have not been sufficient to allow the completion of widespread soil drainage projects to counteract the increasing soil salinity (hence decreasing yields) occasioned by perennial cropping. In short, a rapid improvement in the output of the agricultural sector should not be anticipated.

Industry and Mining - In the last decade, the private sector's share in industrial output increased from just over 20 percent to about one third. Price rigidities, management problems and constrained investment fund availability all contributed to the rather disappointing record of the public (and private) enterprises. This situation was not expected to change in the near future as other sectors (for example, agriculture) imposed increasing pressure for a larger share of the limited investment funds and the limited availability of foreign exchange restrains imports of capital and intermediate commodities. The sector was unable to attain the goals targeted in the five year plan and continued growth in the neighborhood of 5-7 percent was thought likely.

Petroleum - Increased output and increasing international prices during the seventies explain the dramatic increase in this sector in the period after 1975. The price increase continued into the eighties until 1982-1983 when excess supply at the existing price started a downward trend from a high of about U.S.$ 34-35 per barrel. The production of non-Opec members, the failure of Opec members to maintain quota agreements and decreased World consumption culminated in the precipitous price decline of early 1986 to a low of U.S.$ 10-$12 per barrel. While these prices may not represent long run equilibrium, recovery of prices to previous levels (in real terms) was not thought likely. Future increase of the petroleum sector was expected to be moderate to low.

Electricity - Continued expansion of this sector at about 8 percent yearly was anticipated. Government appeared firmly committed to its investment objectives and international funds were available on concessionary terms. Further, serious efforts toward price rationalization were underway to reduce the size of existing implicit energy subsidies.

Construction and Building - Infrastructure had at least a twenty five year history of neglect and indifference. Improved maintenance, renewal and expansion were expected to continue as priority issues as Egypt attempted to correct the deficits occasioned by previous policies and priorities. While growth in the construction sector was subject to substancial fluxuation, a reasonable expectation of growth was thought to be on the order of 7-8 percent annually.

Productive Services - Comprising transport and communications, Suez Canal, trade, finance, insurance and tourism, this sector appeared to have increased annually about 8.9 percent. Large investments in transport and communications were expected to continue, but at a reduced level. Suez revenues appeared stagnant with the prospect of future modest increases. Modest growth was also expected for trade, finance and insurance. In view of recent events, both within Egypt and at the international level, a reduction in tourism earnings was anticipated. Recovery of tourism to previous levels and continued growth would depend on factors largely beyond the control of Egypt. Future increase were expected to be on the order of 4.0-4.5 percent annually.

Social Services - This sector comprises housing, public utilities, health, education and other government social services. The Government's continuing commitment to improve the standard of living of the Egyptian citizen was expressed via priority investment programs for public utilities and low cost housing. The private response in providing average and above average housing had been satisfactory. Continued expansion of this sector at an annual rate of about 5 percent was expected.

Balance of Payments

The use of multiple rates and alterations in those rates makes a precise analysis of this statistical series impossible. Available figures are delineated in Table 5C-3. As is apparent, a large alteration in the valuation of commodities occured during the period 1979-1981. In January 1979, the "official" rate changed from US$ 1.00 = L.E. 0.40 to US$ 1.00 = L.E. 0.70. This rate applied to imports of wheat, wheat flour, edible oil, sugar, tea, fertilizer and insecticides, and to exports of cotton, petroleum and Suez Canal dues. Barter agreements with East European countries used US$ 1.00 = L.E. 0.40. In mid-1981, an "official-incentive" rate of about US$ 1.00 = L.E. 0.84 was established for most import transactions(other than basic commodities) of the public and private sectors. Government also permitted individuals and enterprises with their own foreign exchange to enter free market exchange transactions with others. This free market ranged from US$ 1.00 = L.E. 1.40 to L.E. 2.00 during 1985. The official bank rate (appropriate to expatriate remittances, tourist expenditures, some export and foreign investment inflows, airline tickets and remittances, and some public and private sector imports) was about US$ 1.00 = L.E. 1.35 during 1985.

Despite the above multiplicity within the foreign exchange system, trends were apparent and conclusions obvious. Within exports, agriculture and industry presented a near stagnant picture with no discernable growth trend. Commodity imports, however, were increasing. The magnitude of Egypt's traditional current account deficit had been cushioned by petroleum exports and the service sector. The remaining deficit was covered by an increase in external debt and foreign assistance. The IMF estimated that Egypt's external debt was on the order of $ 33 billion (including military debt) at end 1985, compared to an estimated $ 6.5 billion at end 1975.

Table 5C-3

BALANCE OF PAYMENTS
(current LE millions)

SECTOR	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Current Account - Exports										
Agriculture	185	201	241	180	283	523	526	537	606	NA
Oil (1)	58	99	202	252	638	1,414	1,452	1,424	1,332	NA
Industry	306	296	226	248	367	843	790	723	921	NA
TOTAL	549	596	669	680	1,288	2,780	2,768	2,684	2,859	2,839
TOTAL EXCLUDING OIL	491	497	467	428	650	1,366	1,316	1,260	1,527	NA
Current Account - Imports										
Agriculture	380	414	405	674	615	1,703	1,471	1,537	1,992	NA
Oil (1)	260	405	567	859	823	1,676	1,715	1,779	2,050	NA
Industry	899	671	912	1,099	1,248	3,300	3,383	3,061	3,307	NA
TOTAL	1,539	1,490	1,884	2,632	2,686	6,679	6,569	6,377	7,349	7,734
Current Account Balance (Visibles)	(990)	(894)	(1,215)	(1,952)	(1,398)	(3,899)	(3,801)	(3,693)	(4,490)	(4,895)
Other Sources of Foreign Currency										
Tourism	NA	263	439	396	320	414	318	247	231	NA
Suez Canal	NA	122	167	360	412	546	636	670	682	NA
Expatriate Remittance	NA	720	854	1,676	1,587	2,105	1,407	2,328	2,814	NA
TOTAL	NA	1,105	1,460	2,432	2,319	3,065	2,361	3,245	3,727	NA

Source: Central Bank of Egypt, Consultant estimates

(1) Excludes exports by partner foreign oil companies
(2) Excludes Foreign Aid

Note: From 1980 onwards, Government switched from a calender year to a budget year (mid-year to mid-year). Hence data presented for the period 1980-1984 are as of mid-budget year (December 31).

The continuous deterioration of the current account balance clearly could not be sustained, particularly when considered in the context of the latest developments. Of the four major sources of foreign exchange, only Suez dues showed possibilities of remaining constant. Oil revenues were expected to decrease by around 50 percent and significant increases of other exports in the remaining years of this decade were not thought probable. Tourism receipts were expected to decline by as much as 40 percent, with a slow recovery into the 1990s. Expatriate remittances were expected to remain stable for another year as workers returned with accumulated savings but were likely to decline thereafter as employment opportunities overseas decrease as a result of decreased oil revenues.

Egypt imported about 50 percent of its total foods requirements in 1986. A sizeable reduction in agricultural imports appeared unlikely. The critical issue was how to reduce the remaining import sectors without a reduction in the importation of necessary capital and intermediate commodities which might impose serious restraints on the rate of economic development.

In addition, the burden of servicing foreign debt was expected to increase from its current level of about $ 2.6 billion for the medium and long term public and private obligations. This implied an existing debt service ratio of about 32.8 percent. It was thought that international creditors could face payment delays thus jeopardizing Egypt's credit rating and rendering further credit extensions more difficult. Management of Egypt's balance of payments situation thus implied Government austerity measures.

Public Finance

The Government planned expenditures budget increased at an annual rate of about 11 percent during the 1980's. While revenues increased substantially, actual collections did not attained the planned yearly growth rate of 14 percent, while actual expenditures consistently exceeded the plan, resulting in an annual gross deficit on the order of 5-6 billion LE.

About 65-70 percent of this deficit was covered by domestic borrowing from pension funds and foreign loans and grants. The balance (net deficit) was funded by recourse to the public sector banking system, thus compounding the problem of controlling expenditures by increasing inflationary pressures. Other main contributors to the expenditure control problem were growth of government and public sector payrolls, subsidies for basic necessities and the deficit of public sector companies.

The 1986/87 budget was under review at the time of this Study. Considering the revenue reductions attributable to the drop in international oil prices and decreased tourism, government announced that sizeable cuts in expenditures could be expected with the intention of balancing the budget within five years. While such objectives and an austerity budget were sensible from a financial and economic viewpoint, implementation was undoubtedly politically unattractive and potentially

dangerous However commendable, large cuts in the budget implied major changes in pricing, subsidy, and investment policies and programs. The option of expanded deficit financing via public banking channels remained politically attractive, if financially illusory, but it was throught unwise to anticipate major alterations in the short run. It was thought that multilateral and unilateral foreign assistance could buffer what will be a difficult period for Egypt during the remainder of the 1980's.

Growth Assumptions for The Study

Conditions stimulating growth of the Egyptian economy during the last half of the 1970's were no longer present. While international oil prices were expected to stabilize at a somewhat higher level than prevalent at the time of the Study, return to the previous level was unlikely. Expatriate remittances appeared stable as workers returned with accumulated savings but were expected to decline in the immediate future as major projects reached completion stage and future rapid expansion was unlikely as oil producing nations were confronted with sharply reduced revenues. Recovery of the tourism sector, another principal contributor to foreign exchange and goverment fiscal revenue, was not a short term phenomenon. A significant increase in foreign assistance, both multilateral and unilateral, was thought possible but parochial and international issues precluded regarding such a measure as a long or medium term solution to Egypt's balance of trade and budgetary deficits.

Government announcements appeared to recognize that Egypt had entered a period of austerity. Government intended to balance the budget within five years and large budgetary cuts were expected for 1986/87. Rationing to protect the less advantaged segement of the population, price adjustment upward, reductions of explicit and implicit subsidies and import control were all under consideration.

The economy was considered to have developed enough strength and flexibility to allow a modest annual rate of increase of 4 percent during an adjustment period of 1985-1990. This rate was consistent with apparent rates of current real growth, when taken in the light of recent discontinuities in the economy. The historic growth rate of the Egyptian economy during the period of 1956 through 1985 was estimated to have been 5.8 percent annually. World Bank and other models indicated a potential for long term growth on the order of 6 to 6.5 percent annually. A rate of 6 percent was selected as appropriate for use in the traffic forecasting model during the period 1990-2000. This provided a conservative basis for estimating travel demand and evaluating feasibility.

Appendix 5D

TRAFFIC MODEL INPUTS

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Appendix 5D

TRAFFIC MODEL INPUTS

This Appendix presents the zonal projections estimated for use in forecasting highway traffic within the Cairo-Assuit corridor. National socio-economic projections were distributed to the traffic zone level and combined to produce a regional gross domestic product estimate for each zone.

Zone Plan

Transport demand is explained through quantitative relationships with socio-economic parameters such as population, urbanization, income, production and consumption. Transport flows occur in response to the spatial distribution of socio-economic parameters and the existence of transport infrastructure. For transport analysis and planning, reality is simplified to a schematic, the zoning system. Each traffic zone has a center or node in which all economic and social activities are assumed to be concentrated. The transport network connects these zones and replicates the pathway of passenger and commodity, hence vehicle flows among zones.

Other things being equal, as the number of zones increases the description of transport flows approaches reality. Other things are seldom equal, particularly in regard to reliable and accurate data for the existing situation and the predictable future. Administrative boundaries correspond to the areas for which information is available. For Egypt, reliable economic data was available at the national level only. Periodic household expenditures, industry and employment surveys did provide insight at the governorate level while demographic (census) series were available at the marakez and district level.

This Study was concerned with the Cairo-Assuit corridor. Within the corridor, traffic zone boundaries corresponded to marakez boundaries with the exception of Assuit which was sub-divided. Outside the corridor, less definition was required and the traffic zones were more aggregated. Zone boundaries were, in general, coincident with governorate boundaries. Table 5D-1 presents the sixty four traffic zones by number and descriptive name while Figure 5D-1 and 5D-2 delineate the zone boundaries by zone number.

Population Projections

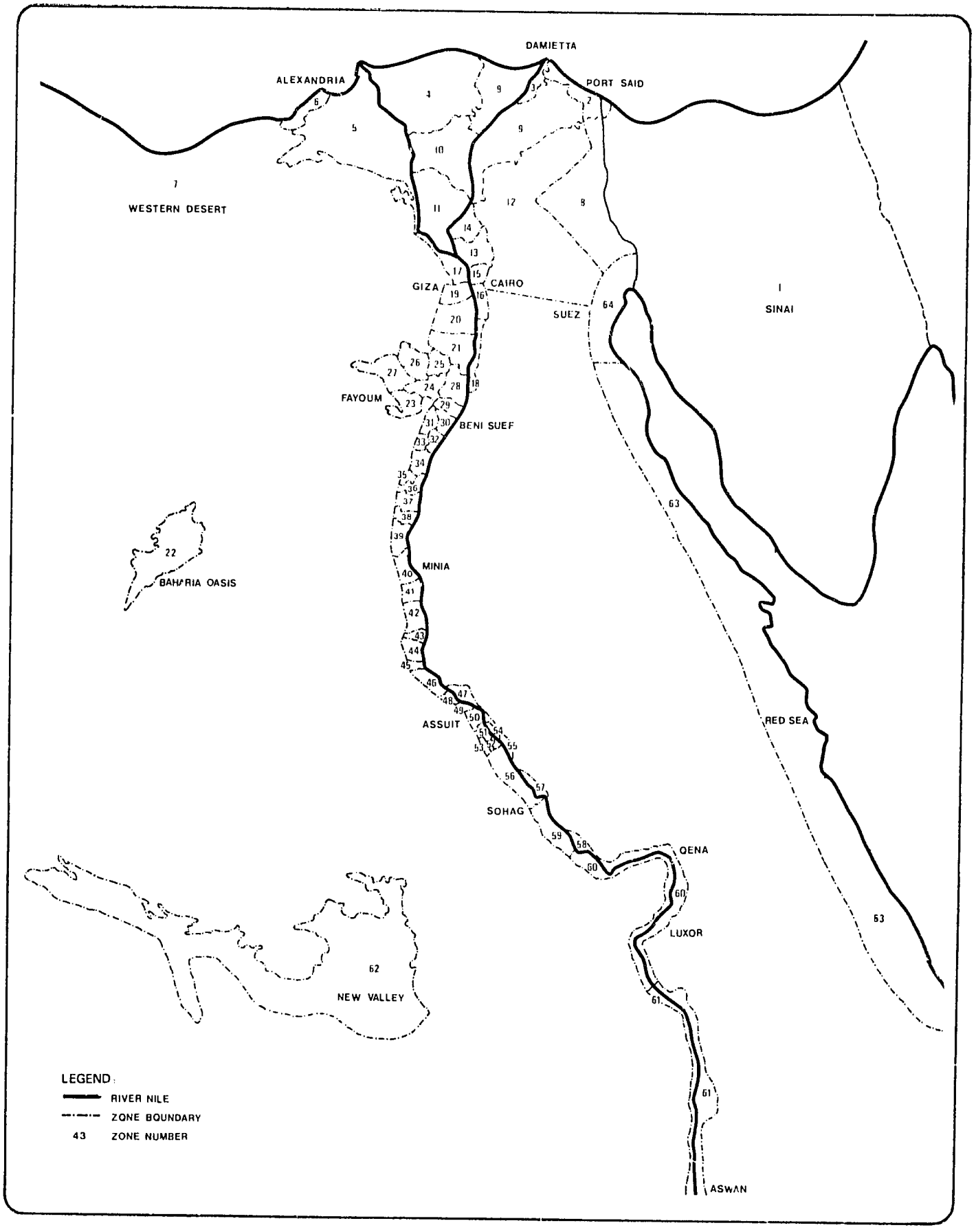
The population analysis techniques presented in the Appendix 5B, whereby adjustments were made to census data to provide a consistent series using boundaries as established by the 1976 Census, rendered the assignment of base year (1976) population to the traffic zone level a relatively straight forward operation. Projections of population and the urban-rural ratio, and the assignment to traffic zones are described in the following sections.

Table 5D-1

TRAFFIC ZONES

ZONE NUMBER	NAME	ZONE NUMBER	NAME
1	Sinai	33	Sumusta
2	Port Said	34	Fashn
3	Damietta	35	Edwa
4	Kafr El Shiekh	36	Maghagha
5	Behera	37	Beni Mazar
6	Alexandria	38	Matai
7	Matrouh	39	Samalut
8	Ismailia	40	Minia
9	Dakahlia	41	Abu Qurqas
10	Gharbia	42	Mallawi
11	Menoufia	43	Deir Mawas
12	Sharkia	44	Dairut
13	Kalyubia South	45	Quisiya
14	Kalyubia North	46	Manfalut
15	Cairo North	47	Abnub
16	Cairo South	48	Assuit, north town center
17	Imbabah	49	Assuit, town center
18	Saff	50	Assuit, south town center
19	Giza	51	Abu Tig
20	Badrashin	52	Sidfa
21	Aiyat	53	Ghanayem
22	Baharia Oasis	54	Sahel
23	Itsa	55	Badari
24	Fayoum	56	Sohag North
25	Tamiya	57	Sohag East
26	Sinnuris	58	Dar El Salam
27	Ibshawai	69	Sohag South
28	Wasta	60	Qena
29	Nasser	61	Aswan
30	Beni Suef	62	New Valley
31	Ihnasya	63	Red Sea
32	Biba	64	Suez

SOURCE: Consultant

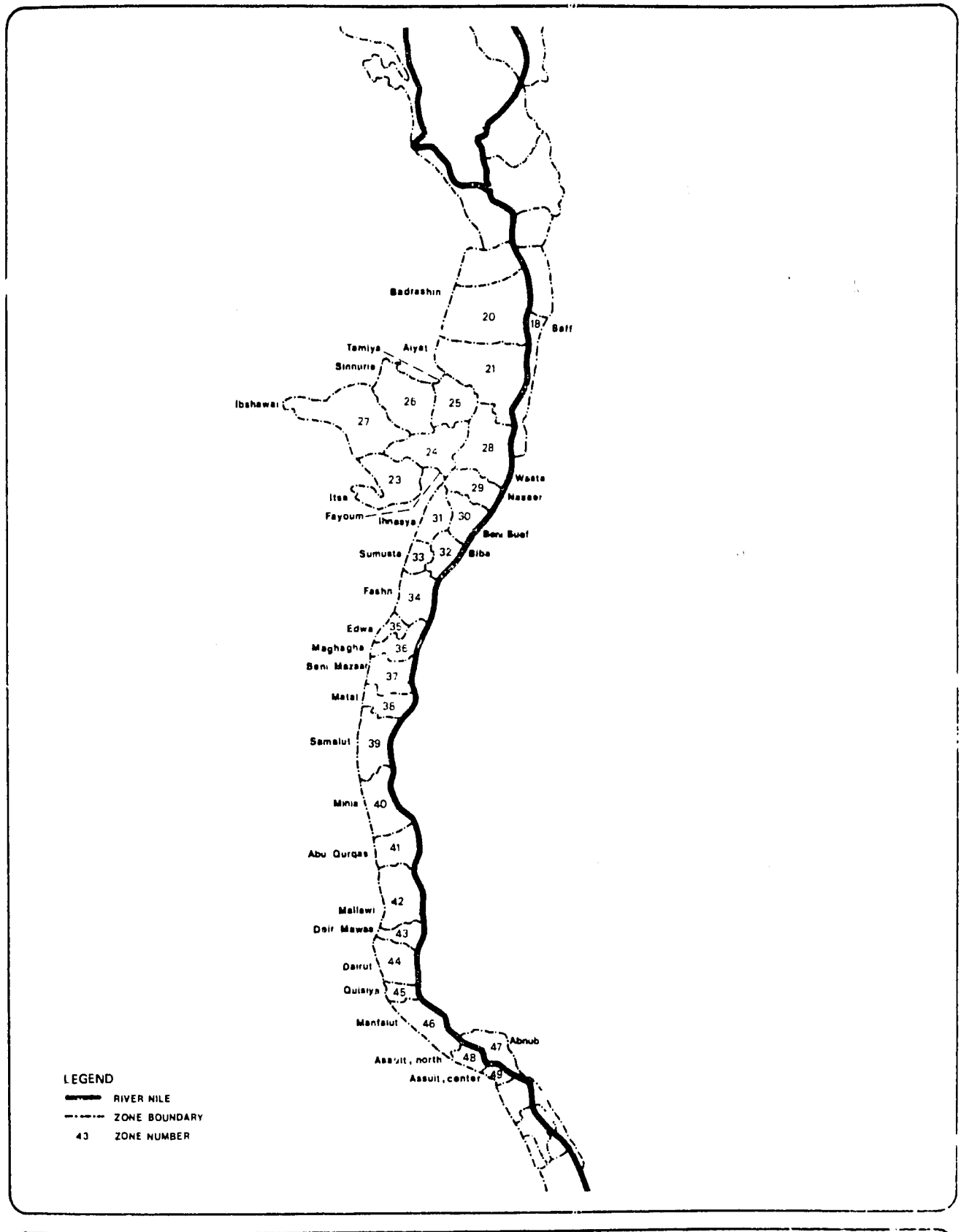


Cairo – Assuit Highway Feasibility Study

ZONE PLAN - EGYPT

Wilbur Smith and Associates
Egyptian Consultants Consortium

Figure 5D-1



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ZONE PLAN - CAIRO ASSUIT CORRIDOR

Figure 5D-2

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After accounting for errors of enumeration and age misreporting, population living within the country according to the 1976 census was taken as a base, and the following assumptions were made:

1) Mortality was assumed to decline in a way that the expectation of life at birth would reach 62.3 years for males and 65.1 years for females by 2000. The corresponding expectations of life for 1976 were estimated as 52.7 and 55.5 years for males and females respectively. According to the appropriate expectation of life, relevant survival ratios were interpolated from model life tables.

2) The effect of the recent emigration phenomenon was isolated. Egyptians living abroad till 2000 were assumed to be always equal to or less than Egyptians abroad in 1976 (1.425 million) and their procreation.

3) As regards fertility, the total fertility rate was assumed to decline from the estimated level of 5.7 live births per woman in 1976 to 5.3, 4.9 and 4.4 live births per woman respectively for "high", "medium" and "low" variants. The starting dates of fertility decline were assumed as 1990, 1985, and 1980 for the three variants respectively. It was assumed, also, that age specific fertility rates would decline relatively more rapidly at younger ages due to the expected effect of the rising age of first marriage, spacing and limiting of children among younger female cohorts.

Using the above assumptions, a "Component Method" of population projection was carried out. Age-sex cohorts were projected in five year increments using accepted age-specific fertility and mortality rates, and accounting for net migration as outlined above. These were prepared in a series of low, medium and high projections as given in Table 5D-2

Table 5D-2

PROJECTED NATIONAL POPULATION 1985-2000
(THOUSAND)

YEAR	POPULATION Low	Medium (thousand)	High
1985	46,437	47,349	47,554
1990	51,988	53,701	54,572
1995	57,441	60,470	62,259
2000	63,167	67,792	70,564

SOURCE: Consultant
Note: Projections are for end calendar year (31 December).

According to these estimates, national population was forecast in the range of 63.2 to 70.6 million. The medium level projection of 67.8 million was adopted for traffic projections. The medium projection was about 2.7 percent higher than the midpoint between the ENTS Phase III high and low projections. There is not a significant difference, however, between the medium projection of this Study and that of the National Urban Policy Study (NUPS) (Reference 2), the difference being only plus four tenths of one percent above the NUPS projection of 67.5 million.

Projected Population Distribution

Total population for each governorate was derived from national population by a ratio method. Trends in governorate ratios to national population were projected based on 1960 and 1976 ratios, and derived ratios were applied to national figures. The same ratio or "step down" method was then used to derive traffic zone projections within governorates, and all projections were balanced to governorate and national baseline projections.

Urban and rural population projections within the traffic zones and governorates were accomplished by applying the urban-rural growth difference (URGD) method developed by the United Nation's staff (Reference 3). This method is based upon analysis of the urban-rural population distribution rate of change relationship in selected statistically developed countries. Standard values, logistically transformed, were established for use in projecting future distribution patterns as a function of the observed historic distribution pattern for the country under analysis. The standard functions provided a relatively rapid rate of urbanization increase at low values of the urban-rural ratio, decreasing as the ratio approached and exceeded one.

Urban and rural projections within governorates or traffic zones were based upon the rates of change calculated after accounting for the effects of reclassification to urban status, declassification to rural status, annexation, and detachment on the level of the smallest census enumeration unit (village and town). Professional judgement was necessary in some cases to adjust the mathematical local projections and distributions in terms of forseable socio-economic development potentials. The main sources of data to guide this process were as follows:

1) Policies; National Population Policy (Reference 4), National Urban Policy Study (Reference 2), National Housing Policy Study (Reference 5), and the Egypt National Transport Study (Reference 1)

2) Plans; Successive Annual and Five-Year National Plans, Regional Plan of Suez Canal Area (Port Said, Ismailia, and Suez governorates), Greater Cairo Regional Plan (Cairo, Giza, and Shubra El-Kheima Cities) Alexandria Master Plan, Regional Development Plan for New Valley, Spatial Development Plans for Red Sea and Mediterranean Sea Coasts, and about 40 structural and/or master plans of medium sized Egyptian cities.

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3) Programs and Potentials of Land Reclamation, Tourism, and Industrial Development, New Cities and Communities, National-Scale Projects such as the new port of Damietta.

4) Legal regulations recently issued to Control Urban Development, Encroachment on Agricultural Land, Vacant and State-owned land.

The final results of urban, rural, and total population projections are included in Annex 5D-1. The data indicate an urban and rural population of 34.251 and 33.541 million by 2000 respectively. The implied corresponding percent is 50.52 percent urban and 49.48 percent rural. This proportion of urban population appeared reasonable considering the fast growing urban population during the period from 1947 which resulted in an urban population of 44.0 percent by 1976. However, the projected urban population as projected was higher than that anticipated by national policy targets. The National Population Council had a goal of reducing the urban proportion to 40.0 percent by the year 2000 (This target was approved by the National Population Council in a session held 19 June 1986, and superintended by President Mubarek).

The 50 percent urban population for 2000 adopted by this Study compares with ENTS Phase III of 60 percent urban and NUPS at 54.8 percent urban in the year 2000. As the two studies did not explicity define the assumptions used as a base for projecting the urbanization trend, the consultant cannot provide a rationale for the divergence in end results by the year 2000 other than differing professional judgement.

A comparison of this Study with NUPS for the year 2000 reveals that projections of the urban population of Greater Cairo more than account for the urbanization trend differences. For the year 2000, rural population for this Study was 3.048 million greater than the rural population adopted by NUPS. The NUPS projection for Greater Cairo urban population was 3.115 million greater than the projection for this Study. NUPS apparently extrapolated the historic annual rate of growth (1947-1976) for Greater Cairo of about 3.7 percent. The 1976 census data indicated a decrease in the rate of increase, particularly for the Cairo Governorate which constituted about 75 percent of the Greater Cairo urban population in 1976. Procedures applied by the consultant resulted in an annual rate of increase of about 2.75 percent to the year 2000 for Greater Cairo.

Gross Domestic Product Per Capita

No direct information was available on regional and/or personal income in Egypt at the macro-economic level. Following procedures adopted by the World Bank and ENTS, this Study used the expenditure data disclosed by the 1974/75 and 1981/82 household budget surveys to estimate regional economic activity. While the surveys were expenditure rather than income, they did give an indication of the income distribution within Egypt.

The 1974/75 survey revealed the average urban household had a per capita level of expenditures (LE 1974/75) of LE 99 while that of the rural household was LE 63. The 1981/82 survey disclosed about the same level of inequality with per capita urban expenditures at LE 288 and rural

at LE 186 (1981/82 LE). As was expected, per capita expenditures were highest in the urban city governorates (LE 323) with the governorates of lower Egypt next (urban LE 264, rural LE 186) and lowest in the governorates of Upper Egypt (urban LE 210, rural LE 172).

Compared with the ENTS study, which encompassed all of Egypt, this Study concentrated on a smaller area, the Cairo-Assuit corridor. Therefore, different procedures were applied to yield more sensitivity to the traffic zone estimates of Gross Domestic Product (GDP).

ENTS used the National average rural/urban per capita income estimates weighted by the respective urban/rural population shares at the traffic zone level. For this Study, zones were classified into three income classes based on the expenditure surveys reported above.

The 1981/82 surveys disclosed a quite similar pattern of expenditure distribution when compared to the 1974/75 data, except for a few discontinuities in the earlier survey. Assuming that the distribution has indeed remained somewhat constant between the two survey dates, the 1974/75 data were expanded to 1981/82 at an average annual rate of 14 percent to account for inflation. The results were then averaged with the 1981/82 data to smooth the series and partially alleviate statistical or sampling errors. These averages were then adjusted using the scaling factor developed by IBRD to account for the different incidence of taxes/savings, urban versus rural, to estimate per capita income from the expenditure data. Arrayed by governorate in an order of magnitude ranking, the data was further adjusted by assigning two income categories to each governorate, one for rural and one for urban, selected from three categories each for rural and urban. These categories comprise average per capita income of the assigned governorates and were as follows:

CATEGORY	PER CAPITA LE 1981/82	
	Urban	Rural
1	770	432
2	630	372
3	540	313

The urban/rural shares of National GDP disclosed by the above procedure were 62 and 38 percent respectively for 1981/82, or the same percent shares estimated by ENTS for 1977. ENTS assumed that rural income would increase at an annual rate equal to growth of the GDP agricultural sector whereas, actually, rural population as defined administratively for the census contained a mixture of urban/rural functions. The stability of the rural GDP share was, therefore, not surprising. Rural/urban shares assumed by this Study reflected the administrative nature of these categories and were as follows:

YEAR	PERCENT GDP	
	Urban	Rural
1985	62%	38%
1990	65%	35%
2000	70%	30%

Application of the share estimate used by ENTS III yielded income estimates which were not in agreement with the 1981/82 survey results. Further, when combined with the population estimate of this Study, ENTS III shares yielded a severe decrease in rural incomes which was not considered probable. Using the above indicated GDP shares, the traffic zone populations were weighed by the income category and the resulting share distributed to each traffic zone for the forecast years. The results are included in Annex 5D-1. The totals indicated that, for all of Egypt, rural income/expenditure per capita might experience a constant level or a modest increase of 0.3 percent annually 1985-1990 and 2.6 percent 1990-2000, while the urban per capita shares increased at 1.75 and 3.7 percent respectively. By 2000, the urban share per capita was expected to have increased from 1.91 times rural to 2.29 times the rural size, on the average.

TRAFFIC ZONE		ZONE CAT 85/86		1990		2000		GROSS DOMESTIC PRODUCT (LE MILLIONS) 1985/86			1990			2000		
No	Name	Ur	Ru	Ur	Ru	Ur	Ru	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Minia Governorate																
35	Edwa	2	2	2	2	2	2	6	40	46	8	45	53	16	71	87
36	Maghagha	2	2	2	2	2	2	33	82	115	43	92	135	78	143	221
37	Beni Mazar	2	2	2	2	2	2	30	85	115	37	95	133	67	146	213
38	Matai	2	2	2	2	2	2	18	47	65	22	53	75	41	84	124
39	Samalut	2	2	2	2	2	2	42	110	152	54	126	180	102	203	305
40	Minia	2	2	2	2	2	2	124	113	237	156	130	287	292	202	495
41	Abu Quirqas	2	2	2	2	2	2	28	93	121	34	105	139	63	161	225
42	Mallawi	2	2	2	2	2	2	61	129	190	77	145	222	143	224	367
43	Deir Mawas	2	2	2	2	2	2	16	58	74	20	64	84	36	96	132
	Sub-total							356	757	1,114	452	856	1,308	838	1,331	2,169
Assuit Governorate																
44	Dairut	3	3	3	3	3	3	22	72	93	26	81	107	47	125	172
45	Quisiya	3	3	3	3	3	3	22	52	74	27	58	85	49	87	136
46	Manfalut	3	3	3	3	3	3	28	57	85	34	64	98	58	100	157
47	Abnub	3	3	3	3	3	3	28	84	112	35	95	130	66	149	215
48	Assuit North	3	3	3	3	3	3	0	35	35	0	40	40	0	63	63
49	Assuit Center	3	3	3	3	3	3	167	0	167	220	0	220	478	0	478
50	Assuit South	3	3	3	3	3	3	0	41	41	0	47	47	0	69	69
51	Abu Tig	3	3	3	3	3	3	24	41	65	29	46	75	50	69	119
52	Sidfa	3	3	3	3	3	3	9	27	36	12	30	42	24	45	69
53	Ghanayem	3	3	3	3	3	3	13	8	21	15	9	24	25	13	38
54	Sahel	3	3	3	3	3	3	10	22	32	12	25	37	20	37	58
55	Badari	3	3	3	3	3	3	18	32	50	22	35	57	38	53	91
	Sub-total							340	471	811	432	528	960	856	809	1,665
Sohag Governorate																
56	Sohag North	3	3	3	3	3	3	162	269	431	202	299	502	386	454	840
57	Sohag East	3	3	3	3	3	3	43	62	106	53	70	123	99	109	208
58	Dar EL Salam	3	3	3	3	3	3	6	53	59	9	59	67	16	92	108
59	Sohag South	3	3	3	3	3	3	68	181	248	82	197	279	140	292	432
	Sub-total							278	566	844	346	625	971	641	946	1,588
60	Qena	2	2	2	2	2	2	314	591	905	388	659	1,047	739	1,001	1,740
61	Aswan	2	3	2	3	2	3	213	140	352	280	151	431	572	209	781
62	New Valley	2	2	2	2	2	2	33	21	54	44	23	68	97	34	131
63	Red Sea	2	2	2	2	2	2	44	4	48	57	5	62	128	7	135
64	Suez	2	2	2	2	2	2	175	0	175	220	0	220	440	0	440
	Sub-total							779	756	1,535	989	837	1,827	1,976	1,252	3,228
	GRAND TOTAL							15,336	9,400	24,736	19,562	10,533	30,095	37,727	16,169	53,896

TRAFFIC ZONE		ZONE CAT 85/86		1990		2000		GROSS DOMESTIC PRODUCT (LE MILLIONS) 1985/86			1990			2000		
No	Name	Ur	Ru	Ur	Ru	Ur	Ru	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
1	Sinai	2	2	2	2	2	2	112	10	121	152	11	163	301	17	318
2	Port Said	1	1	1	1	1	1	298	0	298	373	0	373	709	0	709
3	Damietta	1	1	1	1	1	1	170	228	398	256	247	503	632	366	998
4	Kafr El.Shiekh	3	3	3	3	3	3	210	446	656	279	503	782	561	790	1,350
5	Behra	2	1	2	1	2	1	503	1,093	1,596	665	1,240	1,904	1,349	1,983	3,332
6	Alexandria	1	1	1	1	1	1	2,356	0	2,356	2,964	0	2,964	5,418	0	5,418
7	Matrouh	2	2	2	2	2	2	51	30	81	74	33	107	189	46	236
8	Ismalia	1	1	1	1	1	1	224	91	315	304	106	410	664	176	840
9	Dakahlia	2	2	2	2	2	2	546	955	1,500	704	1,064	1,768	1,339	1,656	2,994
10	Gharbia	1	1	1	1	1	1	769	821	1,590	961	928	1,889	1,837	1,429	3,266
11	Menoufia	3	2	3	2	3	2	233	628	861	360	670	1,031	816	981	1,797
12	Sharkia	2	3	2	3	2	3	457	831	1,288	583	948	1,531	1,227	1,470	2,697
13	Kalyubia Sth	3	2	3	2	3	2	495	227	723	649	264	914	1,270	408	1,678
14	Kalyubia Nth	3	2	3	2	3	2	97	215	312	120	234	354	219	336	555
	Sub-total							6,521	5,574	12,096	8,445	6,248	14,694	16,531	9,658	26,188
	Cairo and Giza Governorates															
15	Cairo North	1	1	1	1	1	1	4,195	0	4,195	5,061	0	5,061	8,967	0	8,967
16	Cairo South	1	1	1	1	1	1	765	0	765	1,060	0	1,060	2,057	0	2,057
17	Imbabah	1	1	1	1	1	1	430	256	687	566	295	861	1,091	422	1,513
18	Saff	1	1	1	1	1	1	19	106	124	24	116	140	48	175	223
19	Giza	1	1	1	1	1	1	1,120	42	1,162	1,517	46	1,563	3,378	69	3,447
20	Badrashin	1	1	1	1	1	1	76	74	150	95	82	177	176	121	297
21	Aiyat	1	1	1	1	1	1	15	69	84	19	75	93	34	111	145
22	Baharia Oasis	1	1	1	1	1	1	16	0	16	23	0	23	51	0	51
	Sub-total							6,637	547	7,184	8,364	613	8,978	15,801	898	16,699
	Fayoum Governorate															
23	Itsa	2	2	2	2	2	2	16	92	108	20	104	124	36	164	199
24	Fayoum	2	2	2	2	2	2	141	80	221	178	91	269	371	129	500
25	Tamia	2	2	2	2	2	2	17	57	74	21	67	88	42	110	152
26	Sinnures	2	2	2	2	2	2	33	71	104	41	81	121	72	127	199
27	Ibshawai	2	2	2	2	2	2	21	108	129	26	122	148	48	193	240
	Sub-total							228	408	636	286	465	751	568	722	1,290
	Beni Suef Governorate															
28	Wasta	3	3	3	3	3	3	14	58	71	17	65	82	55	91	147
29	Nasser	3	3	3	3	3	3	29	35	64	37	39	76	68	63	131
30	Beni Suef	3	3	3	3	2	3	86	56	142	110	63	173	248	102	350
31	Ihnasya	3	3	3	3	3	3	11	43	55	14	49	62	25	76	101
32	Biba	3	3	3	3	3	3	22	52	74	29	57	86	48	89	138
33	Sumusta	3	3	3	3	3	3	11	29	40	14	32	45	23	49	71
34	Fashn	3	3	3	3	3	3	23	49	72	28	55	83	48	83	131
	Sub-total							196	321	517	248	361	608	515	553	1,068

TRAFFIC ZONE		ZONE CAT 85/86		ZONE CAT 1990		ZONE CAT 2000		POPULATION 1985/86			POPULATION 1990			POPULATION 2000		
No	Name	Ur	Ru	Ur	Ru	Ur	Ru	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
1	Sinai	2	2	2	2	2	2	177	26	203	220	29	249	304	34	338
2	Port Said	1	1	1	1	1	1	386	0	386	443		443	585		585
3	Damietta	1	1	1	1	1	1	221	526	747	304	561	865	522	644	1,166
4	Kafr El.Shiekh	3	3	3	3	3	3	388	1,421	1,809	473	1,579	2,052	660	1,920	2,580
5	Behra	2	1	2	1	2	1	798	2,522	3,320	964	2,820	3,784	1,361	3,494	4,855
6	Alexandria	1	1	1	1	1	1	3,056	0	3,056	3,518		3,518	4,473		4,473
7	Matrouh	2	2	2	2	2	2	81	81	162	108	86	194	191	95	286
8	Ismalia	1	1	1	1	1	1	291	210	501	361	241	602	548	310	858
9	Dakahlia	2	2	2	2	2	2	865	2,559	3,424	1,021	2,811	3,832	1,351	3,387	4,738
10	Gharbia	1	1	1	1	1	1	997	1,895	2,892	1,141	2,110	3,251	1,517	2,517	4,034
11	Menoufia	3	2	3	2	3	2	431	1,684	2,115	610	1,771	2,381	961	2,007	2,968
12	Sharkia	2	3	2	3	2	3	724	2,648	3,372	845	2,977	3,822	1,238	3,574	4,812
13	Kalyubia Sth	3	2	3	2	3	2	916	609	1,525	1,099	698	1,797	1,495	835	2,330
14	Kalyubia Nth	3	2	3	2	3	2	179	576	755	203	619	822	258	688	946
	Sub-total							9,510	14,757	24,267	11,310	16,302	27,612	15,464	19,505	34,969
	Cairo and Giza Governorates															
15	Cairo North	1	1	1	1	1	1	5,441	0	5,441	6,007		6,007	7,403		7,403
16	Cairo South	1	1	1	1	1	1	992	0	992	1,258		1,258	1,698		1,698
17	Imbabah	1	1	1	1	1	1	558	592	1,150	672	670	1,342	901	743	1,644
18	Saff	1	1	1	1	1	1	24	244	268	28	264	292	40	308	348
19	Giza	1	1	1	1	1	1	1,453	97	1,550	1,800	105	1,905	2,789	122	2,911
20	Badrashin	1	1	1	1	1	1	98	171	269	113	186	299	145	214	359
21	Aiyat	1	1	1	1	1	1	20	159	179	22	170	192	28	195	223
22	Baharia Oasis	1	1	1	1	1	1	21	0	21	27		27	42		42
	Sub-total							8,607	1,263	9,870	9,927	1,395	11,322	13,046	1,582	14,628
	Fayoum Governorate															
23	Itsa	2	2	2	2	2	2	26	246	272	29	274	303	36	335	371
24	Fayoum	2	2	2	2	2	2	223	215	438	258	241	499	374	264	638
25	Tamia	2	2	2	2	2	2	27	153	180	31	176	207	42	226	268
26	Sinnures	2	2	2	2	2	2	53	190	243	59	213	272	73	259	332
27	Ibshawai	2	2	2	2	2	2	33	289	322	38	323	361	48	394	442
	Sub-total							362	1,093	1,455	415	1,227	1,642	573	1,478	2,051
	Beni Suef Governorate															
28	Wasta	3	3	3	3	3	3	25	184	209	29	205	234	65	222	287
29	Nasser	3	3	3	3	3	3	53	111	164	62	124	186	80	153	233
30	Beni Suef	3	3	3	3	2	3	159	177	336	186	199	385	250	248	498
31	Ihnasya	3	3	3	3	3	3	21	138	159	23	153	176	29	185	214
32	Biba	3	3	3	3	3	3	41	165	206	49	179	228	57	217	274
33	Sumusta	3	3	3	3	3	3	21	91	112	23	100	123	27	118	145
34	Fashn	3	3	3	3	3	3	42	157	199	47	172	219	57	202	259
	Sub-total							362	1,023	1,385	419	1,132	1,551	565	1,345	1,910

TRAFFIC ZONE		ZONE CAT 85/86		ZONE CAT 1990		ZONE CAT 2000		POPULATION 1985/86			POPULATION 1990			POPULATION 2000		
No	Name	Ur	Ru	Ur	Ru	Ur	Ru	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
	Minia Governorate															
35	Edwa	2	2	2	2	2	2	9	107	116	11	119	130	16	146	162
36	Maghagha	2	2	2	2	2	2	52	220	272	63	242	305	79	292	371
37	Beni Mazar	2	2	2	2	2	2	48	228	276	54	252	306	68	298	366
38	Matai	2	2	2	2	2	2	28	126	154	32	141	173	41	171	212
39	Samalut	2	2	2	2	2	2	66	295	361	78	333	411	103	416	519
40	Minia	2	2	2	2	2	2	196	303	499	227	344	571	295	414	709
41	Abu Quirqas	2	2	2	2	2	2	44	249	293	50	277	327	64	330	394
42	Mallawi	2	2	2	2	2	2	97	346	443	111	383	494	144	458	602
43	Deir Mawas	2	2	2	2	2	2	25	156	181	29	170	199	36	197	233
	Sub-total							565	2,030	2,595	655	2,261	2,916	846	2,722	3,568
	Assuit Governorate															
44	Dairut	3	3	3	3	3	3	40	228	268	44	253	297	55	304	359
45	Quisiya	3	3	3	3	3	3	41	166	207	46	181	227	58	212	270
46	Manfalut	3	3	3	3	3	3	51	182	233	57	201	258	68	242	310
47	Abnub	3	3	3	3	3	3	52	268	320	60	298	358	78	362	440
48	Assuit North	3	3	3	3	3	3	0	110	110		125	125		154	154
49	Assuit Center	3	3	3	3	3	3	308	0	308	372		372	563		563
50	Assuit South	3	3	3	3	3	3	0	132	132		147	147		167	167
51	Abu Tig	3	3	3	3	3	3	44	131	175	49	143	192	59	167	226
52	Sidfa	3	3	3	3	3	3	17	86	103	20	94	114	28	109	137
53	Ghanayem	3	3	3	3	3	3	24	25	49	26	27	53	30	31	61
54	Sahel	3	3	3	3	3	3	18	71	89	20	78	98	24	91	115
55	Badari	3	3	3	3	3	3	34	101	135	37	110	147	45	128	173
	Sub-total							629	1,500	2,129	731	1,657	2,388	1,008	1,967	2,975
	Sohag Governorate															
56	Sohag North	3	3	3	3	3	3	299	858	1,157	342	940	1,282	454	1,105	1,559
57	Sohag East	3	3	3	3	3	3	80	199	279	90	220	310	117	264	381
58	Dar EL Salam	3	3	3	3	3	3	11	169	180	15	184	199	19	223	242
59	Sohag South	3	3	3	3	3	3	125	576	701	138	619	757	165	709	874
	Sub-total							515	1,802	2,317	585	1,963	2,548	755	2,301	3,056
60	Qena	2	2	2	2	2	2	498	1,584	2,082	563	1,740	2,303	746	2,048	2,794
61	Aswan	2	3	2	3	2	3	337	445	782	406	473	879	577	509	1,086
62	New Valley	2	2	2	2	2	2	52	57	109	64	62	126	98	69	167
63	Red Sea	2	2	2	2	2	2	70	10	80	83	12	95	129	15	144
64	Suez	2	2	2	2	2	2	278	0	278	319		319	444		444
	Sub-total							1,235	2,096	3,331	1,435	2,287	3,722	1,994	2,641	4,635
	GRAND TOTAL							21,785	25,564	47,349	25,477	28,274	53,701	34,251	33,541	67,792

Appendix 5E

COSTS OF HIGHWAY TRANSPORT

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Appendix 5E

COSTS OF HIGHWAY TRANSPORT

Determination of the costs of highway transport under varying conditions was a fundamental task of the Study. This Appendix discusses the Study requirements for transport costs, and then describes the procedures followed and assumptions made.

Requirements for Highway Transport Costs

Highway transport costs were required at two separate stages of the Study. First, they were required at the transport forecasting stage, since costs influence the level of demand for transport, and also the choice of route by drivers. Secondly, they were required at the evaluation stage, in order to determine the benefits resulting from alternative investments in highway facilities.

Costs for Transport Forecasting - The volume of traffic using the roads is influenced by the price paid for transport. The effect of rising prices over a period of time will be to slow the growth in road traffic as individual travelers and transporters of goods decide against making trips or transport movements of only marginal usefulness. On the other hand, reducing prices will accelerate the traffic growth rate.

For most travelers and transporters, the price of transport is determined by the transport tariff, whether for taxi, bus or truck. For owners of private vehicles (cars, pickups and trucks), it is the financial cost of using the vehicle which determines the price. That is, the actual costs paid for the fuel, tires, maintenance and other components of operating costs, including any duties, taxes or subsidies.

This Study assumed that there is a link between financial costs and tariffs. For example, if fuel costs go up, so will tariffs. The adjustment in tariffs might not happen immediately but, over a period of time, tariffs will follow changes in financial costs. Therefore, all transport costs used in forecasting transport demand and route choice were based on the financial operating costs of vehicles. However, two important adjustments were made.

Tariffs for passenger and goods vehicles were obtained by applying a tariff adjustment factor to the financial costs, in order to reflect any discrepancy between the two. For example, it was thought that current tariffs were below actual financial costs, but that this could change in the future. Without introducing an excessive number of vehicle classes, it was not possible to differentiate between vehicles for private use only and vehicles for public service. Therefore, the tariff factor applied to all vehicles in the vehicle class, even to trucks used by private companies.

Secondly, research has shown that owners of private vehicles do not necessarily take account of all costs when making transport decisions.

While private truck owners, usually companies used to record keeping, are thought to take full account of all costs, private car owners generally consider only the cost of fuel, oil and tires, ignoring maintenance costs and the cost of depreciation. On the other hand, private car owners are more influenced by travel delays due to congestion, so that the value of time must be taken into account in the financial cost of private car operations. In sum, then, the costs of using a private car as perceived by the owner consist of fuel, oil, tire and time costs.

For all classes of transport, the price of transport includes any direct charges levied, in particular, the costs of road use tolls.

Hence transport costs for transport forecasting were based on financial costs, adjusted for tariff levels, the perception of costs (including that of time) by private owners, and toll charges. These costs were referred to in this Study as financial perceived costs.

Costs for Evaluation - While financial costs of transport shape transport making decisions by private vehicle owners and users of transport services, they are a poor guide to the true costs of transport when viewed from the point of view of the Nation. This is because financial costs include duties and taxes, which are simply a transfer of money from citizens and companies to Government, and also reflect subsidies which represent a transfer of money in the reverse direction. None of duties, taxes or subsidies reflect the consumption of real economic resources of the Nation. This is better measured by what are termed economic resource costs, or economic costs for short. They are obtained by adjusting financial costs to eliminate duties, taxes and subsidies, and to reflect any special valuation of particularly scarce resources. See Appendix 5A for more details.

Since time is a National resource, valuations of both passenger travel time and time in transit of cargo were included in the evaluation stage. However, since the value placed on time can vary widely, any project benefits due to time savings were maintained and reported separately.

During the evaluation, it was also useful to identify the foreign exchange content of transport costs, in order to assess the implications of borrowing abroad for the alternative investments.

Finally, the evaluation process must identify any social and environmental costs of transport operations. In practice, this is normally restricted to the costs of traffic accidents for each alternative. Identification of the costs associated with noise, vehicle emissions, spills, visual intrusion and other pollutions are required in many developed countries, but require a very detailed knowledge of costs and attitudes. Without adequate information on these subjects in the context of the Egyptian environment, these aspects were treated in a qualitative manner in this Study.

Selected Vehicles

Transport costs vary considerably by vehicle type, ranging per

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kilometer from perhaps ten piastas for a car to over a pound for a large truck. Therefore a range of vehicle types was selected and vehicle operating cost estimated separately for each.

The selection of vehicle types was based on the results of the Roadside Interview Survey (RIS) conducted by this Study in December 1985/January 1986, and was also influenced by the selection of representative vehicle types in the Egypt National Transport Study (ENTS)(Reference 1).

The RIS survey found the number of vehicles shown in Table 5E-1 below operating in the corridor on a typical day (after adjustment for multiple counting of long distance vehicles passing more than one survey station):

Table 5E-1

SURVEYED VEHICLES

CLASS	NUMBER	PERCENT
1. Private Car	10,721	14.9 percent
2. Taxi Car	13,448	18.6
3. Taxi Van	10,071	14.0
4A. Pickup (goods)	17,157	23.8
4B. Pickup (pass)	2,691	3.7
5. Microbus	1,154	1.6
6. Standard bus	2,695	3.7
7. Single truck	9,838	13.6
8. Combin truck	1,507	2.1
9. Artic truck	581	0.8
10. Other motors	2,273	3.2
TOTAL	72,136	100.0

After examining the characteristics of vehicles revealed in the Roadside Interview Survey tabulations, the vehicles were re-grouped as follows:

The private car was split into two classes, one for work purpose (about 55 percent of all private cars) and the second for all other purposes.

Taxi cars were maintained as a separate class, as were pick-ups (goods). This last class was the biggest and contains a variety of vehicle types and uses, ranging from a pure private car to a light truck. However, there was no way of separating the data from the interviews to break the class down further.

Passenger pickups, that is to say pickups equipped with seats in the goods section, were combined with the taxi van to form one class. The two vehicles had similar size and seating

characteristics.

Trucks have such economic importance that it was decided to maintain all three truck types separately. The two bus classes were combined.

Hence the final vehicle set for both costing and subsequent modelling purposes was as set out in the Table 5E-2.

Table 5E-2

SELECTED VEHICLE TYPES

1. Private car (work purpose)
2. Private car (other purpose)
3. Taxi car
4. Taxi van
5. Pickup
6. Bus
7. Single truck
8. Combination truck
9. Articulated truck

Vehicle Characteristics - A survey was made of the characteristics and costs of vehicles in Egypt, guided by the RIS survey results and by the ENTS Study. Vehicle characteristics are summarized in Table 5E-3.

With the main exception of the taxi car, none of the selected vehicles represented one specific model, rather average characteristics were compiled to represent the spread of vehicles observed in the Study surveys, considering such things as carrying capacity (passenger and cargo) and vehicle weights.

All vehicle characteristics were based on locally manufactured or assembled vehicles, with two exceptions; the taxi car and the articulated truck. The taxi car was taken as the Peugot 504, capable of seating 7 persons and which remains the pre-dominant inter-city taxi car. The articulated truck was based on the imported Mercedes models.

The private car was taken as a small 4-seater which are becoming increasingly common in Egypt. The taxi van was a new category since the ENTS Study. It represented an increasingly common vehicle which can provide greater comfort and service than a standard bus, but at lower cost per passenger than a taxi. The characteristics of the bus were an average of those found for the standard 42-seat bus and the newer 27-seat micro-bus.

The pick-up is a rapidly growing vehicle class, providing a compromise between a truck and a passenger vehicle, and which can serve both purposes. The vehicle selected for this Study was a little larger than that selected by ENTS, and reflected the increasing proportion of locally

Table 5E-3

VEHICLE CHARACTERISTICS

ITEM	PRIVATE CAR	TAXI CAR	TAXI VAN	PICKUP	BUS	TRUCK SINGLE	TRUCK COMB	TRUCK ARTIC
Engine								
Fuel (Petrol=1, Diesel=2)	1	1	1	1	2	2	2	2
Engine Power (BHP)	51	96	80	80	125	125	250	250
Vehicle Weight (tons)								
Empty	1.0	1.0	1.2	1.5	10.0	5.0	12.5	12.5
Maximum Weight	1.5	1.9	2.7	3.5	12.0	13.0	42.5	37.5
Load Factor	0.00	0.00	0.50	0.25	0.86	0.50	0.50	0.50
Average Weight	1.0	1.0	2.0	2.0	11.7	9.0	27.5	25.0
Number of Passengers	2.5	5.0	9.0	2.0	30.0	1.0	1.0	1.0
Vehicle Utilization								
Annual Driving Hours	417	1,667	1,500	1,270	2,000	1,000	1,500	1,500
Annual Kilometers (thous)	25	100	75	70	100	50	75	75
Vehicle Life (years)	10	7	7	7	8	10	8	8

Source: Consultant

manufactured pick-ups which were generally larger than the imported models. As designated in this Study, the pickup should be judged as more of a cargo vehicle than passenger carrying. The service taxi vehicles adapted from pickups were separated out and included with the taxi vans, and few pickups appeared to be used as they are in developed countries as a private car with cargo facilities. For this reason, they were costed with a driver at a salary, instead of as a private vehicle with no crew.

Considering purely cargo carrying vehicles, the characteristics in terms of weight and carrying capacity of the light truck of the ENTS study corresponded closely with the averages observed in the surveys of this Study for all single trucks. This vehicle had an 8-ton carrying capacity and maximum weight of 13 tons, and was configured with two single axles.

The combination truck selected corresponds approximately to the larger of the two combination truck considered by ENTS, with a 3-axle truck (S-2T) hauling a 2-axle drawbar trailer. The carrying capacity was 30 tons but it ran on average about half full. The articulated truck corresponds to the smaller of the two ENTS vehicles, with an axle configuration of a 3-axle tractor (S-T) and a 2-axle semi-trailer. The carrying capacity was 25 tons and it also ran on average about half full. This pair of large trucks gave a reasonable approximation to the mix of large trucks in the Cairo-Assuit corridor.

Vehicle Utilization - Increases were made in the utilization rates of vehicles assumed by the ENTS study, considering the average vehicle journey lengths found in the Study surveys. The values of annual driving hours, annual kilometers and vehicle life given in Table 5E-3 reflect these adjustments.

Unit Costs of Vehicles - Unit vehicle costs are shown in Table 5E-4, summarizing the import value (CIF) of either the entire vehicle or the components for local assembly, together with duties, taxes and dealer markup and local assembly costs (if any). The financial cost is simply the sum of the previous values. The economic cost is the above value, with duties and taxes removed, and with the CIF value adjusted by the shadow price for foreign exchange (see Chapter 2). In this case, all CIF values were factored by 1.333, the ratio of the shadow exchange rate selected by this Study (1.80) to the 1986 exchange rate for these transactions (1.35). Unit vehicle prices were required without tires, so these were deducted from the calculated costs. Vehicle prices were found from a survey of local agents and for the most part showed a 20 percent increase over the ENTS 1983 estimates. Car costs (private and taxi) had risen faster, and both bus and single truck costs had risen more slowly.

Table 5E-5 sets out all unit costs associated with vehicle operations, including labor and fuel costs. A large increase in cost over ENTS was found for the pickup which, as noted above, was a larger vehicle than considered by ENTS, being based on the locally manufactured vehicles which were protected from imports by high customs duties. The estimated costs of the articulated vehicle were also much higher than assumed by ENTS. The discrepancy cannot be explained, but reliance was placed on survey findings of this Study.

Table 5E-4

COST OF VEHICLES
(LE 1985)

VEHICLE TYPE	CIF VALUE	DUTIES & TAXES	PROFIT MARGIN	VEHICLE COST INCLUDING TIRES		NUMBER OF TIRES	COST OF TIRES		VEHICLE COST EXCLUDING TIRES	
				Econom	Finan		Econom	Finan	Econom	Finan
Car	5,044	1,124	757	7,481	6,925	4	54	55	7,265	6,705
Taxi Car	7,770	8,384	3,846	14,203	20,000	4	83	85	13,871	19,660
Taxi Van	9,697	8,303	4,000	16,926	22,000	4	54	55	16,710	21,780
Bus	9,900	5,390	28,710	41,907	44,000	6	182	186	40,815	42,884
Pickup	5,544	3,690	7,023	14,402	16,258	4	83	85	14,070	15,918
Truck Single	8,506	3,642	10,752	22,090	22,900	6	225	230	20,740	21,520
Truck Comb	28,733	12,376	47,025	85,325	88,134	18	267	273	80,519	83,220
Truck Artic	83,300	21,179	18,621	129,660	123,100	14	267	273	125,922	119,278

Source: Consultant Survey

Table 5E-5

UNIT COSTS OF VEHICLES, PARTS AND LABOR
(All costs in LE)

ITEM	COST TYPE	PRIVATE CAR	TAXI CAR	TAXI VAN	PICKUP	BUS	TRUCK SINGLE	TRUCK COMB	TRUCK ARTIC
Vehicle	For X	5,044	7,770	9,697	5,544	9,900	8,506	28,733	83,300
	Eco	7,265	13,871	16,710	14,070	40,815	20,740	80,519	125,922
	Fin	6,705	19,660	21,780	15,918	42,884	21,520	83,220	119,278
Tire	For X	5	8	5	8	18	23	27	27
	Eco	54	83	54	83	182	225	267	267
	Fin	55	85	55	85	186	230	273	273
Mechanic (per hour)	For X	0	0	0	0	0	0	0	0
	Eco	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
	Fin	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Crew (per year)	For X		0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Eco		4,500	4,500	3,800	6,000	4,500	6,000	6,000
	Fin		4,500	4,500	3,800	6,000	4,500	6,000	6,000
Fuel (per liter)	For X	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Eco	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214
	Fin	0.200	0.200	0.200	0.200	0.030	0.030	0.030	0.030
Oil (per liter)	For X	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Eco	1.20	1.20	1.20	1.20	0.78	0.78	0.78	0.78
	Fin	1.20	1.20	1.20	1.20	0.78	0.78	0.78	0.78
Interest Costs (%)	For X	12%	12%	12%	12%	12%	12%	12%	12%
	Eco	12%	12%	12%	12%	12%	12%	12%	12%
	Fin	12%	12%	12%	12%	12%	12%	12%	12%
Standing Costs (%)	For X	0%	0%	0%	0%	0%	0%	0%	0%
	Eco	8%	7%	7%	7%	12%	24%	17%	17%
	Fin	10%	8%	8%	8%	14%	28%	19%	19%

Tire costs were based entirely on locally manufactured tires, which is a trend which appeared to have strengthened since ENTS. Costs of mechanics were based on a survey of repair shops, and crew costs were based on information derived from contacts with the trucking community, in particular the public trucking companies and the Trucking Cooperatives.

The foreign exchange component of costs were estimated separately for vehicles and tires, considering import of raw materials (such as rubber for tires) and the imported components which are assembled in Egypt. Estimates of the foreign exchange component of spare parts (required in the vehicle operating cost model) was estimated at 20 percent of the economic cost, since most spare parts were manufactured locally, and vehicle operators do not often use original manufacturer parts.

The financial costs of gasoline and diesel fuel were included at the current prices of 20 and 3 piastas per liter respectively. For economic costs of fuel, no differentiation was made between the two fuel types and a value of 21.4 piastas per liter was adopted. This was based on a shadow price of US$ 20 per barrel and exchange rate of US$ 1.00 = LE 1.80 (see Appendix 5A for a discussion on shadow pricing and exchange rates). Since all fuel is produced locally, a zero foreign exchange component was appropriate.

Interest rates of 12 percent were used as in ENTS. The standing costs which represent a a fixed overhead cost on vehicle operations, were derived from ENTS data

Vehicle Operating Cost Models

The calculation of vehicle operating costs can be a complex process taking into account both the characteristics of the vehicle and the characteristics and condition of the highway. A very important parameter to consider is vehicle speed, and this is influenced by vehicle and road characteristics, and also by the number and behavior of other vehicles on the road.

Many computer models are available for estimating vehicle operating costs. Based on the previous experience of the consultants, two models were selected for use in this Study.

The first model was the vehicle operating cost module of Release II of the Highway Design and Maintenance Standards Model (HDM) issued by the World Bank (Reference 6). This was used to calculate free-flow vehicle operating costs over a wide range of vehicle operating speeds for ideal roadway conditions; that is, for a flat straight highway with a good surface and with no interference from other traffic.

The second model used was the Highway Investment Analysis Model (HIAP) issued by the United States Department of Transportation (Reference 7). This was used principally to establish the effects of congestion on vehicle operating costs, estimating the costs of the speed-change cycles, stop cycles and idling time which are experienced on a highway as traffic

builds up. HIAP relationships were also used to allow for the effects of highway geometry and condition, although this task could have been performed also by the HDM model.

Calibration of the HDM Model - Estimates of free-flow vehicle operating costs were made using the HDM model. The ENTS study also estimated free-flow vehicle operating costs under similar conditions of a straight level road in good condition. To ensure the utmost comparability between this Study and ENTS, the HDM model was calibrated to give the same results as ENTS for the ENTS vehicle characteristics and unit costs. This process developed calibration factors which could then be applied to all subsequent estimates of free-flow costs by this Study using the updated vehicle characteristics and unit costs.

The calibration was made assuming a completely flat and straight paved road of 7 meters width, and with an average roughness of 2,500 mm/km. This corresponds to the "good" road described by ENTS. Calibration factors were developed for the consumption the main elements of vehicle operating costs; namely, fuel, oil, tires, spare parts and maintenance labor. Depreciation and interest costs were calculated in a similar manner by the two Studies and no calibration factor was required.

In general, HDM tended to overestimate consumption rates compared with ENTS, so it was necessary to adjust HDM results down to ENTS levels. The main downward adjustment required was to the estimates of spare parts consumption, but the overestimation of spare parts consumption is a well known weakness in the HDM Release II model which was used here. The complete array of calibration factors developed by comparison with ENTS is shown on the first page of the vehicle operating cost model output included in Annex 5E-1 to this Appendix.

Free-Flow Vehicle Operating Costs

As discussed above, free-flow vehicle operating costs were estimated using the HDM model. The model was first calibrated to be compatible with the ENTS Study, but the cost tables developed made use of the vehicle characteristics and unit costs developed for this Study. A complete set of model outputs are included in Annex 5E-1 to this Appendix.

Tables 5E-6 and 5E-7 summarize financial and economic costs respectively by component for each vehicle type (costs for the two cars are identical). The percentage distribution of costs, also shown in the tables, is shown in Figure 5E-1 and 5E-2 for cars and truck combinations respectively.

All costs were calculated for a flat straight road in excellent condition, rated at a roughness of 2000 mm/km. The car and taxi costs were estimated for a speed of 80 kilometers per hour, and the remaining vehicles for 60 kilometers per hour. Percentage costs are also displayed in the tables.

Depreciation and interest costs made up a large proportion of total costs for all vehicle types. These represented the rate at which the vehicle is being used up over the lifetime, and the economic costs of keeping capital tied up in the vehicle.

Table 5E-6

FINANCIAL VEHICLE OPERATING COSTS
(LE 1985)

ITEM	PRIVATE CAR	TAXI CAR	TAXI VAN	PICKUP	BUS	TRUCK SINGLE	TRUCK COMB	TRUCK ARTIC
Component Cost per 1000 kilometers								
Fuel	15.9	17.9	37.1	17.9	5.2	4.9	21.3	17.7
Oil	5.4	6.6	2.2	7.4	5.4	5.6	7.4	7.4
Tires	3.8	4.5	1.8	4.5	21.2	26.2	58.4	45.3
Spare Parts	4.2	12.6	24.3	17.7	86.2	24.6	91.2	76.4
Maint labor	1.3	1.6	2.1	3.1	21.1	15.5	23.0	13.4
Crew	0.0	42.9	56.1	53.6	57.7	88.3	77.7	77.7
Depreciation	28.9	29.2	38.8	33.0	54.6	29.8	87.8	204.5
Interest	15.9	11.2	16.3	13.5	24.8	25.3	64.7	92.7
Total Running Costs	75.5	126.5	178.7	150.8	276.1	220.3	431.5	535.1
Standing Costs	7.6	10.1	14.3	12.1	38.7	61.7	82.0	101.7
Total cost per 1000 km	83	137	193	163	315	282	514	637
Total cost per year:	2,101	14,341	15,470	11,536	32,723	14,371	39,645	49,157
Total cost per veh-km:	0.08	0.14	0.19	0.16	0.31	0.28	0.51	0.64
Total cost per pass-km:	0.03	0.03	0.02	0.08	0.01	0.28	0.51	0.64
Total cost per ton-km:	NA	NA	0.26	0.33	0.18	0.07	0.03	0.05
Percent Costs								
Fuel	19.1%	13.1%	19.2%	11.0%	1.6%	1.8%	4.2%	2.8%
Oil	6.6%	4.8%	1.1%	4.5%	1.7%	2.0%	1.5%	1.2%
Tires	4.6%	3.3%	0.9%	2.8%	6.7%	9.3%	11.4%	7.1%
Spare Parts	5.1%	9.2%	12.6%	10.9%	27.4%	8.7%	17.8%	12.0%
Maint labor	1.6%	1.2%	1.1%	1.9%	6.7%	5.5%	4.5%	2.1%
Crew	0.0%	31.4%	29.1%	32.9%	18.3%	31.3%	15.1%	12.2%
Depreciation	34.8%	21.4%	20.1%	20.3%	17.3%	10.6%	17.1%	32.1%
Interest	19.1%	8.2%	8.4%	8.3%	7.9%	9.0%	12.6%	14.6%
Standing costs	9.1%	7.4%	7.4%	7.4%	12.3%	21.9%	16.0%	16.0%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Consultant

Note: Assumes a flat, straight road with roughness of 2,000 mm/km, with speeds of 80 kph for passenger vehicles and 60 kph for cargo vehicles (including pickups).

Table 5E-7

ECONOMIC VEHICLE OPERATING COSTS
(LE 1985)

ITEM	PRIVATE CAR	TAXI CAR	TAXI VAN	PICKUP	BUS	TRUCK SINGLE	TRUCK COMB	TRUCK ARTIC
Component Cost per 1000 kilometers								
Fuel	17.0	19.1	39.7	19.1	36.9	35.3	152.3	125.9
Oil	5.4	6.6	2.2	7.4	5.4	5.6	7.4	7.4
Tires	3.7	4.4	1.8	4.4	20.7	25.6	57.1	44.3
Spare Parts	4.6	8.9	18.6	15.7	82.0	23.7	88.2	80.7
Maint labor	1.3	1.6	2.1	3.1	21.1	15.5	23.0	13.4
Crew	0.0	42.9	56.1	53.6	57.7	88.3	77.7	77.7
Depreciation	31.3	20.6	29.8	29.2	52.0	28.7	84.9	215.9
Interest	17.2	7.9	12.5	11.9	23.6	24.4	62.6	97.9
Total Running Costs	80.6	112.0	162.8	144.5	299.4	247.1	553.3	663.1
Standing Costs	6.5	7.8	11.4	10.1	35.9	59.3	94.1	112.7
Total cost per 1000 km	87	120	174	155	335	306	647	776
Total cost per year:	2,204	12,583	13,962	10,951	34,861	15,619	49,974	59,901
Total cost per veh-km:	0.09	0.12	0.17	0.15	0.34	0.31	0.65	0.78
Total cost per pass-km:	0.03	0.02	0.02	0.08	0.01	0.31	0.65	0.78
Total cost per ton-km:	NA	NA	0.23	0.31	0.20	0.08	0.04	0.06
Percent Costs								
Fuel	19.5%	16.0%	22.8%	12.4%	11.0%	11.5%	23.5%	16.2%
Oil	6.2%	5.5%	1.2%	4.8%	1.6%	1.8%	1.2%	1.0%
Tires	4.3%	3.7%	1.0%	2.9%	6.2%	8.4%	8.8%	5.7%
Spare Parts	5.3%	7.4%	10.7%	10.1%	24.5%	7.7%	13.6%	10.4%
Maint labor	1.5%	1.4%	1.2%	2.0%	6.3%	5.1%	3.6%	1.7%
Crew	0.0%	35.8%	32.2%	34.7%	17.2%	28.8%	12.0%	10.0%
Depreciation	36.0%	17.2%	17.1%	18.9%	15.5%	9.4%	13.1%	27.8%
Interest	19.8%	6.6%	7.2%	7.7%	7.0%	8.0%	9.7%	12.6%
Standing costs	7.4%	6.5%	6.5%	6.5%	10.7%	19.4%	14.5%	14.5%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Consultant

Note: Assumes a flat, straight road with roughness of 2,000 mm/km, with speeds of 80 kph for passenger vehicles and 60 kph for cargo vehicles (including pickups).

Fuel was a large component for all vehicles for economic costs, but shrank to a very small item for vehicles using the heavily subsidized diesel fuel when considering financial costs, the cost actually paid when the fuel tank is filled. For this reason, the fuel component in Figures 5E-1 and 5E-2 has been highlighted. Oil costs were low for most vehicles, reaching a maximum of nearly 7 percent of costs for private cars.

Labor costs components (crew and maintenance) were the same for both financial and economic costs; only the percentage costs varied as the other components went up or down. In all cases, apart from private cars, crew costs were a substantial item of operating cost.

Perceived Financial Costs - The costs shown in Table 5E-6 represent full financial costs without adjustment. For use in transport forecasting, a tariff factor of 0.9 was applied to the financial costs of all taxis, buses and trucks to represent the estimated shortfall in revenues compared with full operating costs. It was felt that pickups were used on a more informal basis and probably had less problem in covering costs from revenues, so no tariff factor was applied to these costs.

It was difficult to get accurate information on the relationships between tariffs and costs, and there appeared to be a wide variation in the level of tariffs applied. Private owners of trucks (a minority of truck users) of course did not charge tariffs and had to cover all their costs. Public trucking company tariffs, on the other hand, did not cover all their costs since it was understood that depreciation and interest were components are not charged. The tariff factor, therefore, was no more than an educated guess at the average cost of transport to the user of transport services.

As noted before, the car driver was assumed to perceive that only some of his costs affected the cost of a journey. Other charges were considered as a fixed overhead on owning a car, even though in practice they were also affected by use. Therefore, only the costs of fuel, oils and tires were included in the costs of car operations for transport forecasting purposes. These perceived cost components are highlighted in Figure 5E-1.

Variation in Costs by Speed - Consumption rates vary with speed so that the composition of operating costs at different speeds varies. Annex 5E-1 contains detailed cost tables, and these are also illustrated in Figures 5E-3 and 5E-4. for passenger and cargo vehicles respectively.

For all vehicle types, costs were highest at very low speeds, but dropped sharply to reach a minimum in the range 20 to 40 kilometers per hour. Thereafter, as speed went up, costs rose very gently or remained almost constant. The exact shape of the curves depended on the complex cost equations in the HDM model.

Comparison with ENTS - The final report of Phase III of ENTS compared free-flow vehicle operating costs changes between 1979 and 1983. These costs were compared with costs developed in this Study for those

vehicle types in common. The comparisons are presented in Table 5E-8 below for a road in good condition (2,500 mm/km roughness) and for speeds of 80 kph for passenger vehicles and 60 kph for cargo vehicles.

Table 5E-8

FREE FLOW VEHICLE OPERATING COST COMPARISON WITH ENTS
(LE per 1000 kms)

	FINANCIAL COSTS			ECONOMIC COSTS		
	ENTS 1979	ENTS 1983	CAS 1985	ENTS 1979	ENTS 1983	CAS 1985
Private car	51	73	90	57	87	94
Taxi car	71	119	150	73	123	130
Pickup	72	88	180	82	103	170
Bus	185	331	334	226	372	354
Truck single	169	300	291	210	333	315
Truck comb	302	500	537	455	732	670
Truck artic	326	456	656	460	642	795

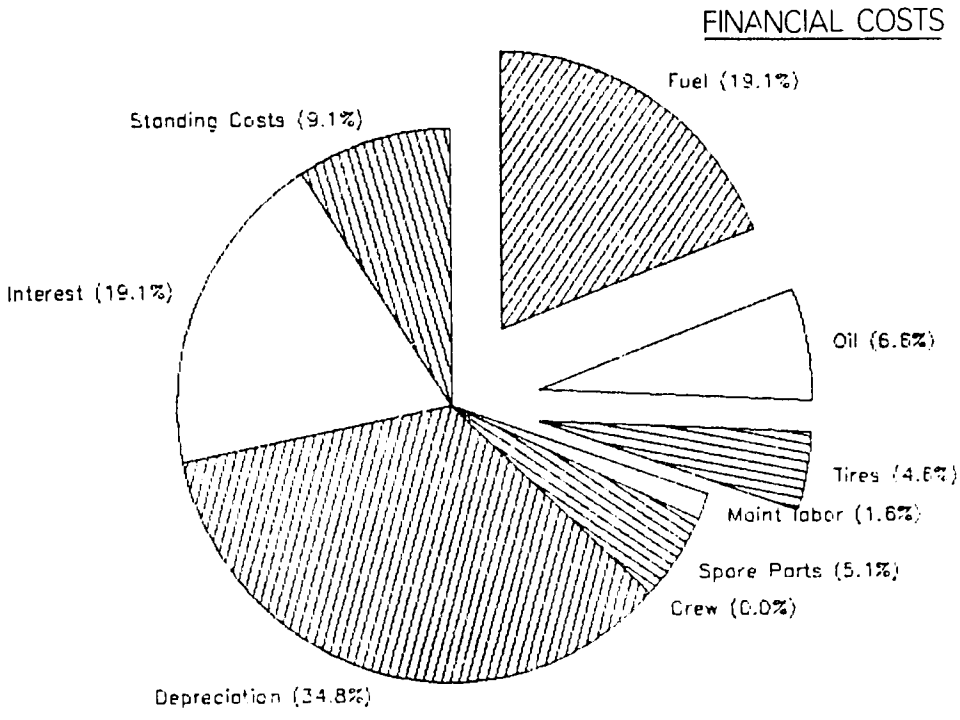
The increase in pickup costs was explained by the change in vehicle type and the higher costs of the locally manufactured vehicles. Bus costs rose only slightly; this was partly because of higher utilization assumed in this Study and partly by the averaging of standard bus and microbus costs. Both single and combination truck costs fell, entirely because of the higher utilization assumed for the Cairo-Assuit corridor. The rise in articulated truck costs was probably attributable to differences in data sources.

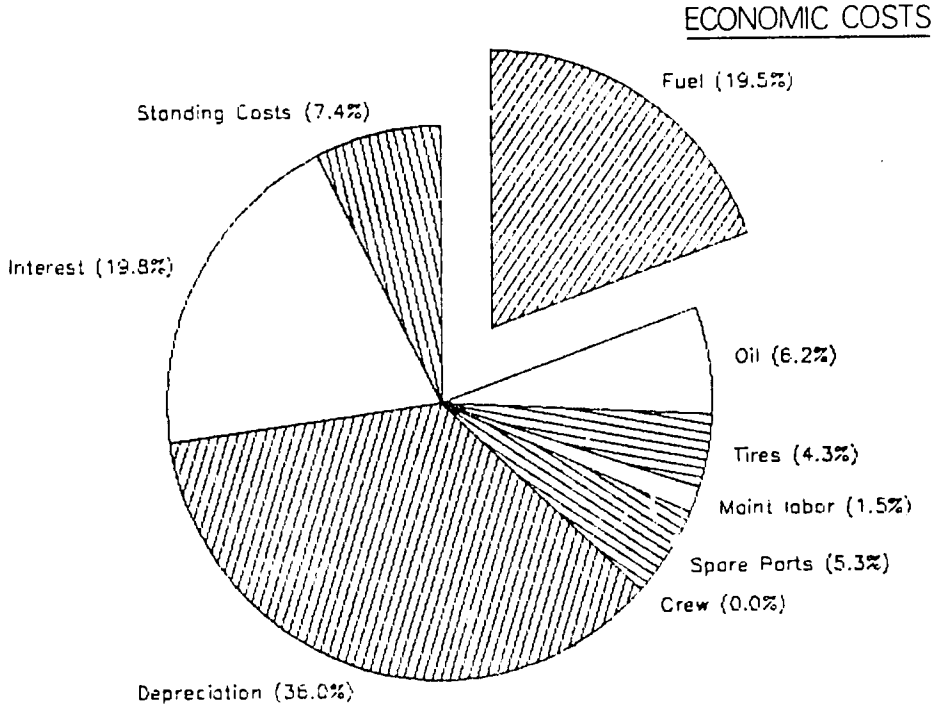
Vehicle Operating Cost Adjustments

Having established vehicle operating costs for a flat and straight road in excellent condition, it was necessary to consider adjustment factors to cover less than perfect conditions. These include the following:

i) Road Geometry
ii) Road Surface
iii) Congestion

Road Geometry - It is normal to adjust operating costs for both curvature and grades, but in these respects, the main West Bank Cairo-Assuit Highway was quite unusual in being exceptionally well aligned. The road ran along the banks of the El Ibrahim canal for most of its length, and sections of 10-20 kms at a stretch were perfectly straight and level. Almost the same could be said of the existing East Bank highway from Helwan to Beni Suef, although the section south of Beni Suef under construction has some gentle grades. Certainly the new Cairo-Assuit Expressway under consideration is planned to have gentle curves and few grades. Some minor roads considered by the Study (access roads to some marakez capitals off the main highway) had curves, but carried





Cairo – Assuit Highway Feasibility Study

PRIVATE CAR OPERATING COSTS

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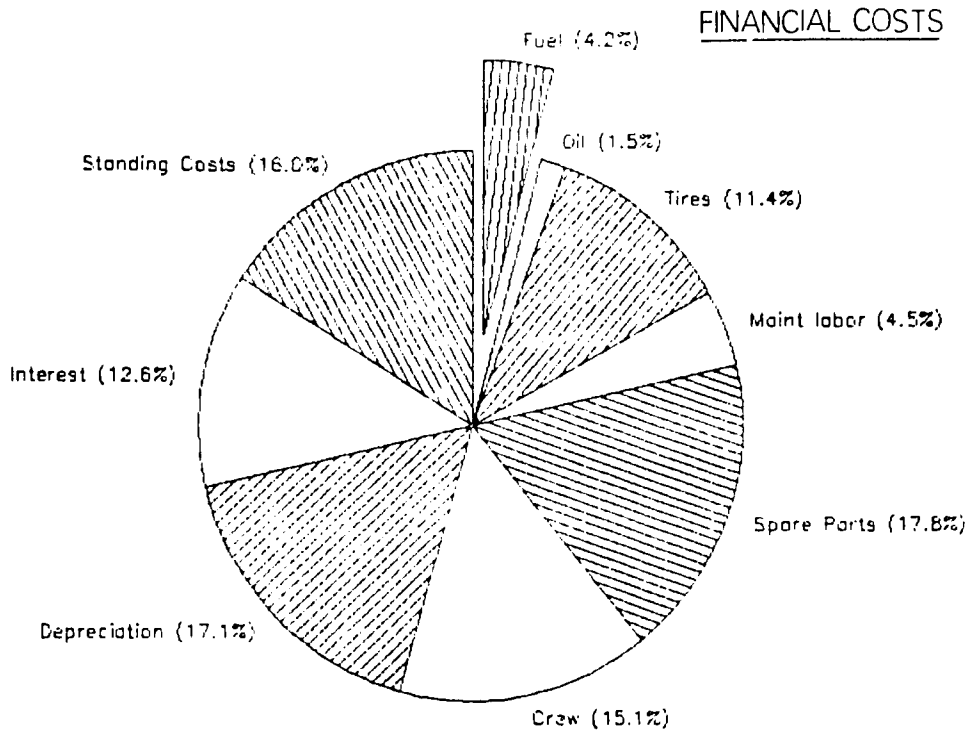
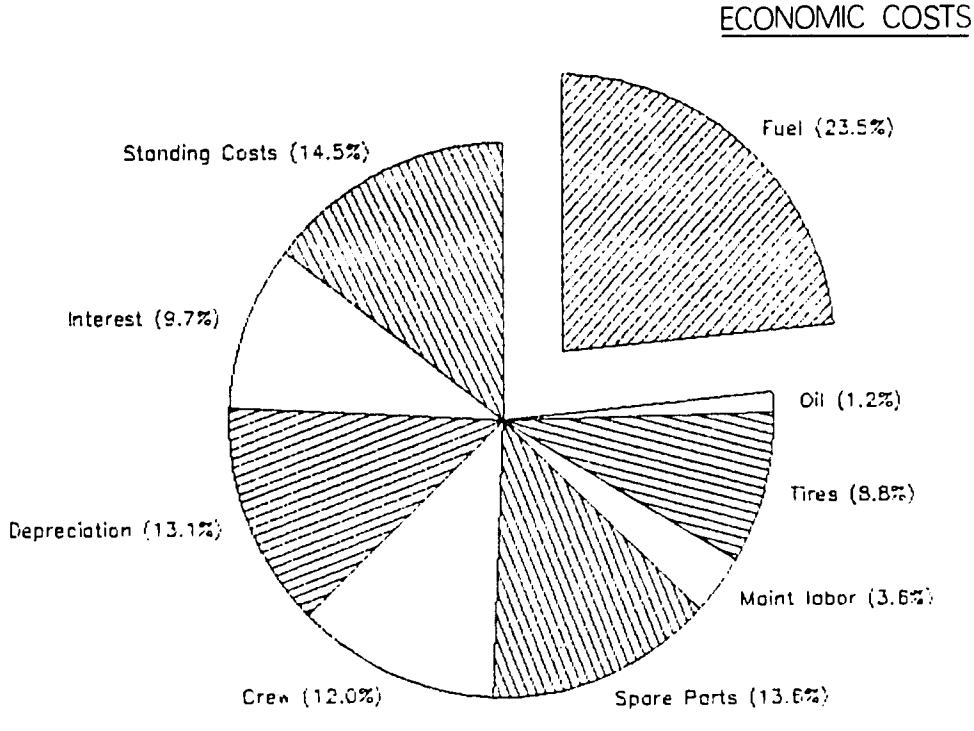
Figure 6E-1





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TRUCK COMBINATION OPERATING COSTS

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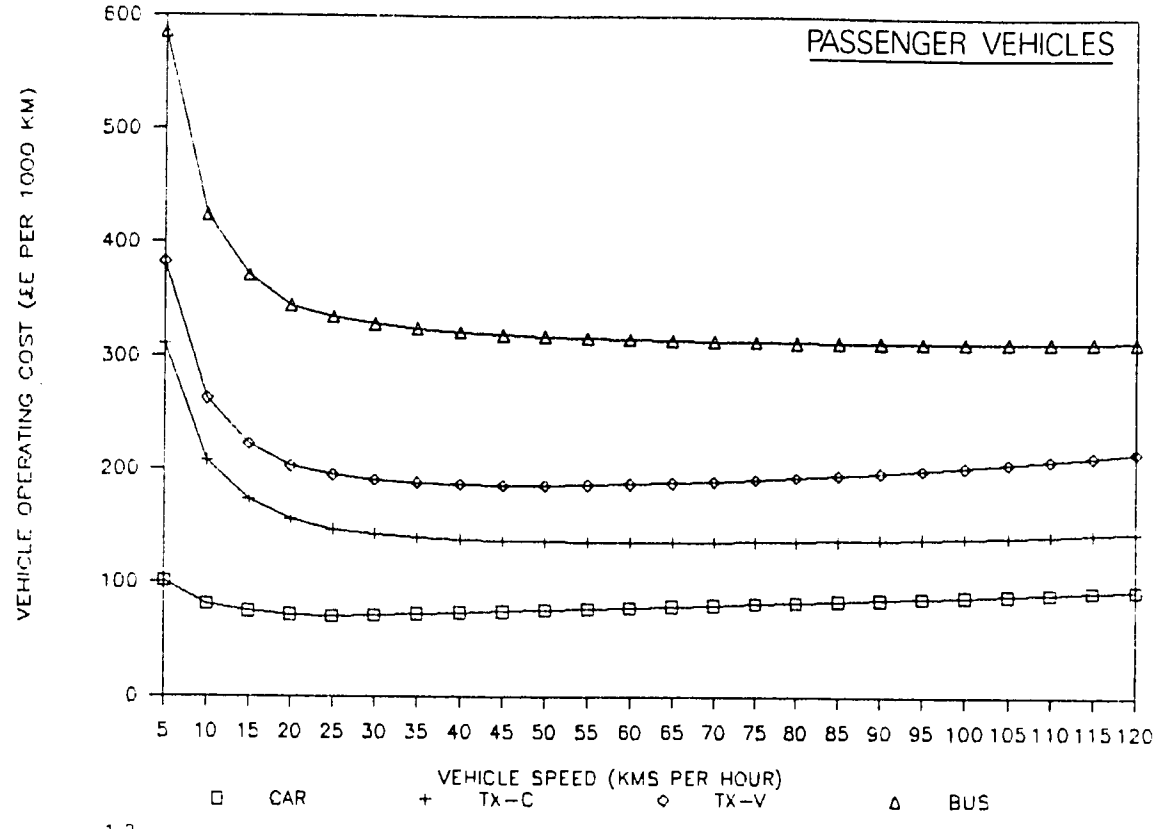
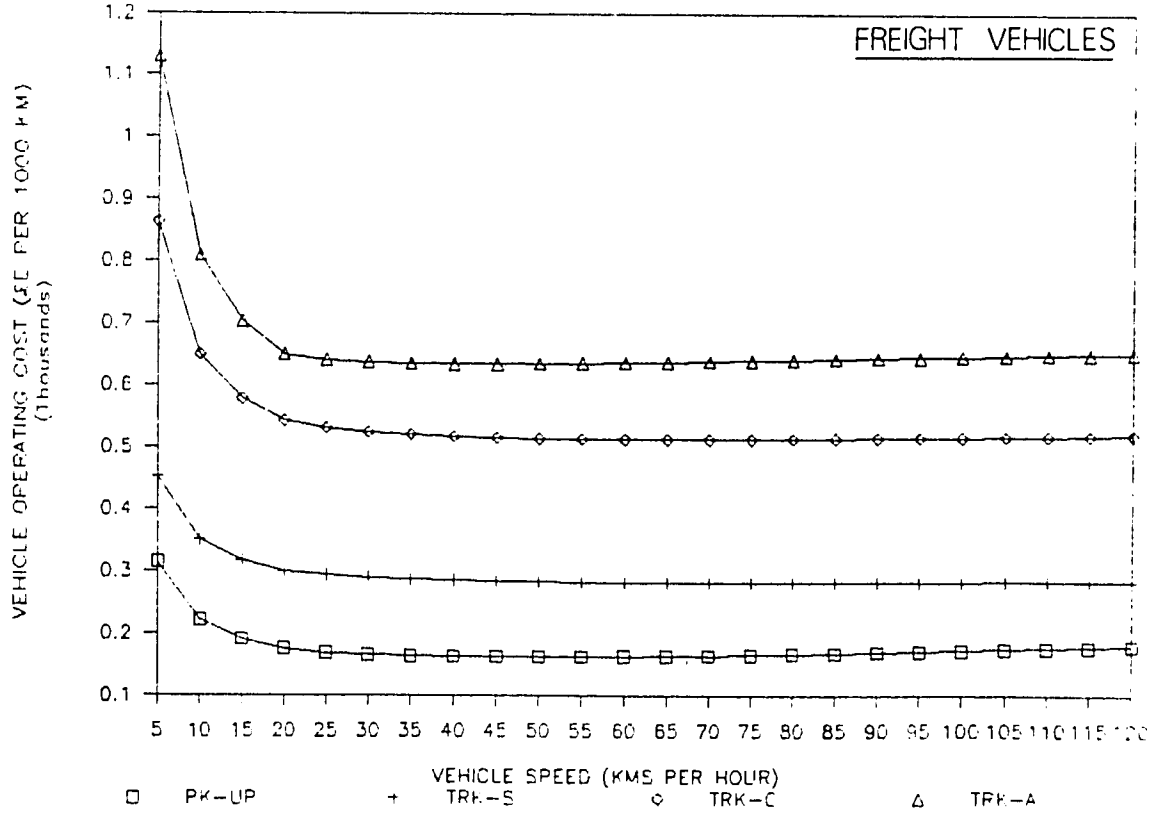
Figure SE-2





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FINANCIAL VEHICLE OPERATING COSTS BY SPEED

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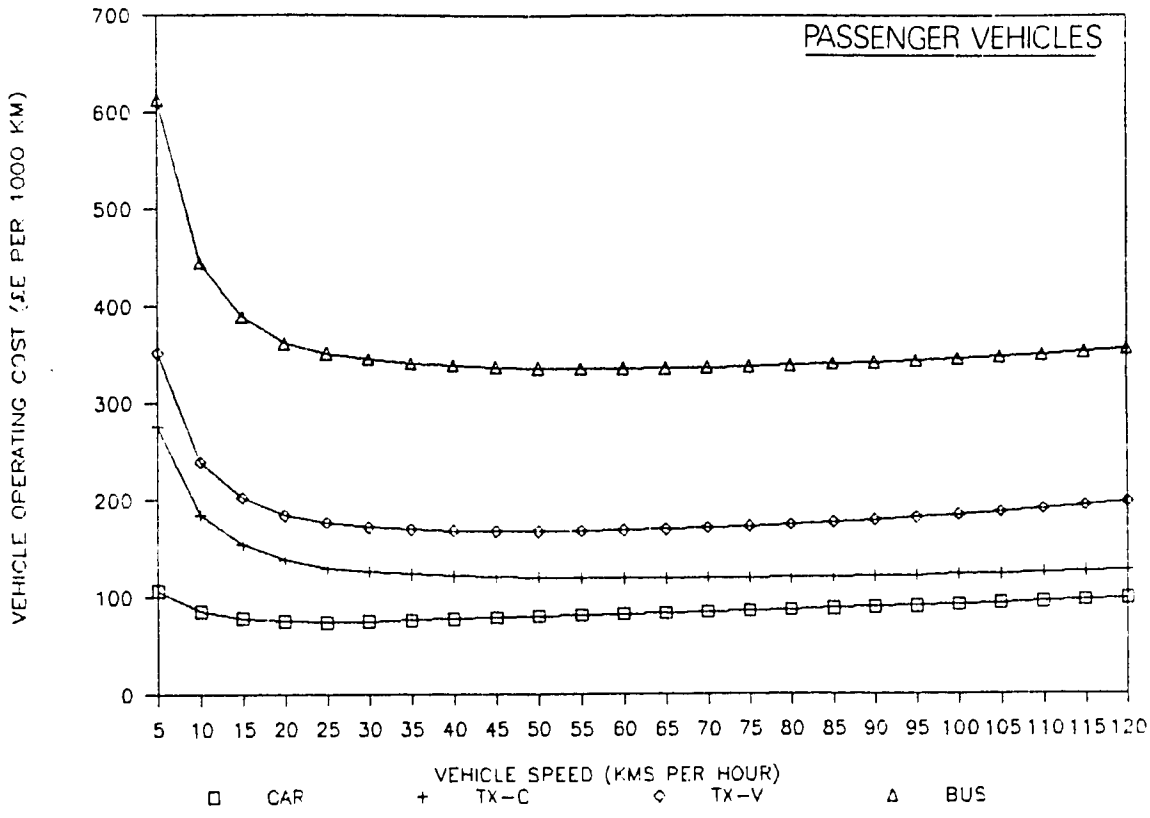
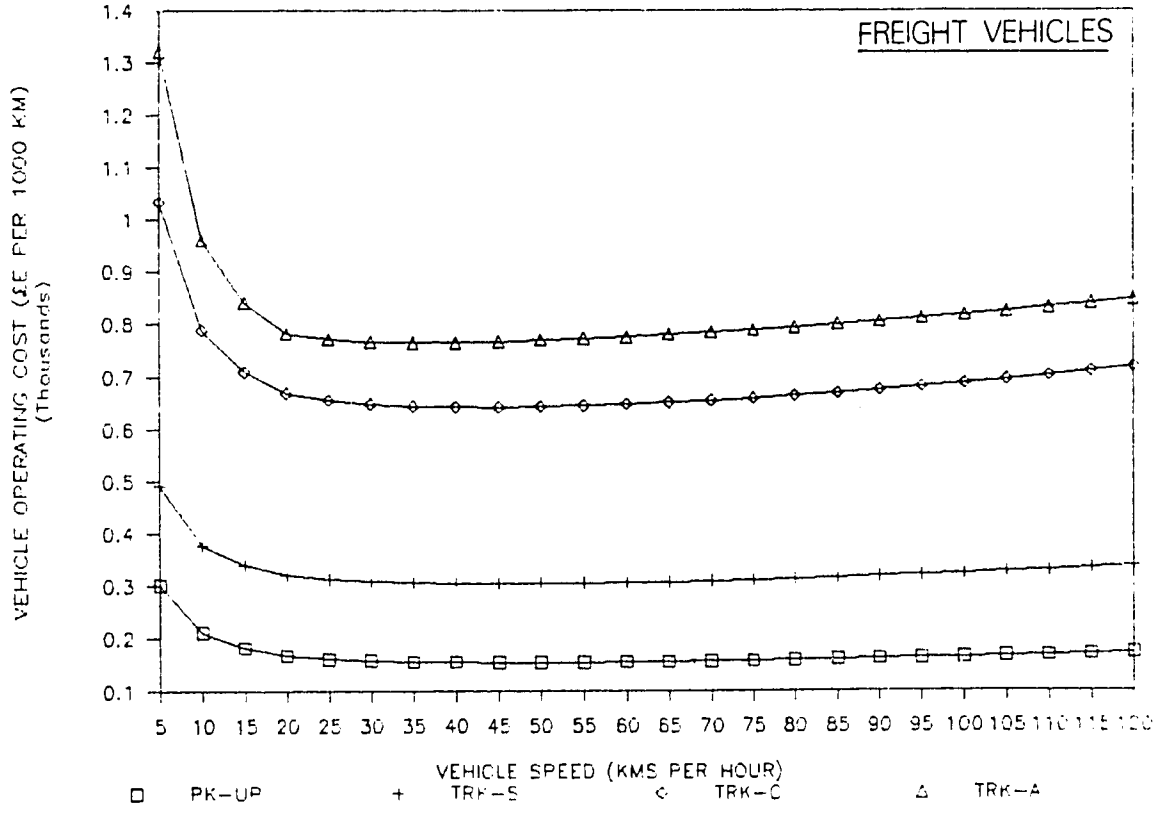
Figure 8E-3





Cairo – Ismailia Highway Feasibility Study

ECONOMIC VEHICLE OPERATING COSTS BY SPEED

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Figure 06-4

relatively little traffic in relation to the main road.

For these reasons, no adjustments or additions were made to the vehicle operating cost tables to correct for road geometry. The only correction for this aspect was to code an increase of 5 percent over the planned length for the new East Bank Highway under construction between Beni Suef and Minia, to allow for the grades in that section.

Road Surface - Road surface conditions have a very significant effect on vehicle operating costs. The HDM vehicle cost model, as calibrated for this Study, was used to investigate the impact of surface condition on the operating costs for each vehicle type, with the results as set out in Table 5E-9 below.

Table 5E-9

VEHICLE OPERATING COST ADJUSTMENT
FACTORS FOR ROAD SURFACE CONDITION

SURFACE CONDITION	PRIV CAR	TAXI CAR	TAXI VAN	PICK -UP	BUS	TRCK SING	TRCK COMB	TRCK ART
Excellent (2000 mm/km)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Very Good (2500 mm/km)	1.08	1.09	1.08	1.05	1.06	1.03	1.04	1.03
Good (3000 mm/km)	1.16	1.18	1.16	1.10	1.11	1.06	1.07	1.05
Fair (3500 mm/km)	1.24	1.26	1.24	1.16	1.16	1.09	1.11	1.08

Congestion Costs - As traffic volumes build up on a road, the effects of congestion start to be felt. Drivers must make more frequent adjustments to speed to adjust for other vehicles, both in the same traffic stream and, on two-lane roads, for vehicles coming in the opposite direction. In extreme congestion, such as may be experienced in towns, vehicles may have to stop and wait for periods.

These effects of congestion are measured by the following three parameters: i) speed-change cycles, ii) stop cycles, and iii) idling time. Speed-change cycles and stop cycles refer to a complete operation of slowing down from an operating speed to a lower speed, perhaps a complete stop, and then speeding up again to the former operating speed. Congestion affects both the time of the journey, and also the vehicle operating costs, since energy is expended in slowing down and speeding up, and this is felt in consumption of such things as fuel and tires.

Standard tables are available showing the excess costs and excess time

consumed in speed-change and stop cycles and in idling, for a variety of vehicle types. The term 'excess' refers to costs and time in addition to the free flow costs and times, derived in this Study from the HDM model as described above.

The tables of excess costs and time chosen for this Study were taken initially from the Highway Investment Analysis Package (HIAP) (Reference 7) and the tables of excess hours were retained. For excess operating cost associated with congestion, a more recent report was used, also issued by the US Department of Transportation (Reference 8), which contains the results of a major study updating vehicle operating costs.

While the tables of excess time could be applied directly (after carefully matching vehicle types), the tables of excess cost had first to be processed to make them suitable for use for the vehicle types selected for this Study. This was done by expressing the cost per speed change cycle as a fraction of the free flow cost of the vehicle at the speed departed from and returned to. These fractions could then be applied directly to the free-flow costs estimated by this Study as reported above. Table 5E-10 shows examples of the tables for excess hours and excess costs of speed change cycles, stop cycles, and idling. These tables apply to cars and taxis; a complete set of tables for all vehicle types is contained in Annex 5E-2.

The computation of the number of speed change and stop cycles was based on equations specified in the HIAP model. The details of the methodology are presented in Appendix 6B.

Time Costs

Appenix 5A discussed values of time for passengers and cargo, noting that these depend on trip purpose for passengers, and on average cargo value.

Passenger time values per vehicle-hour were required for evaluation purposes. Crew time was not valued in this calculation since it is fully accounted for in the crew costs of vehicles, and no time value was attributed to passengers in trucks and pickups. Passenger time costs, therefore, were calculated for all occupants of private cars, and for the passengers only in taxis and buses. Note that the passenger time values for private cars were used both in the transport forecasting stage, being an element of perceived motoring costs, and in the evaluation stage. Passenger time costs for taxis and buses were required only for evaluation.

The value of passenger time is normally held to vary with trip purpose. Values adopted by this Study were 75 percent of the wage rate for work or business related travel, and 30 percent of the wage rate for other travel. Based on occupancies and journey purpose mix observed in the surveys, the passenger time values set out in Table 5E-11 below were adopted:

Table 5E-10

EXCESS COST FACTORS AND HOURS ASSOCIATED WITH CAR SPEED-CHANGE CYCLES

INITIAL RUNNING SPEED (kph)	SPEED REDUCED TO AND RETURNED FROM, KPH													
	Stop	8	16	24	32	40	48	56	64	72	80	88	96	104
	EXCESS HOURS CONSUMED PER 1000 SPEED CHANGE CYCLES													
8	1.02													
16	1.51	0.62												
24	2.00	1.12	0.46											
32	2.49	1.62	0.93	0.35										
40	2.98	2.11	1.40	0.80	0.28									
48	3.46	2.60	1.87	1.24	0.70	0.23								
56	3.94	3.09	2.34	1.69	1.11	0.60	0.19							
64	4.42	3.58	2.81	2.13	1.52	0.97	0.51	0.16						
72	4.90	4.06	3.28	2.57	1.93	1.34	0.83	0.42	0.13					
80	5.37	4.54	3.75	3.01	2.34	1.71	1.15	0.68	0.35	0.11				
88	5.84	5.02	4.21	3.45	2.74	2.08	1.47	0.94	0.57	0.28	0.09			
96	6.31	5.50	4.67	3.88	3.14	2.44	1.78	1.20	0.78	0.45	0.21	0.07		
104	6.78	5.97	5.13	4.31	3.54	2.80	2.09	1.45	0.99	0.62	0.36	0.18	0.05	
112	7.25	6.44	5.58	4.74	3.94	3.16	2.40	1.70	1.19	0.78	0.50	0.30	0.16	0.04

EXCESS COST OF 1000 SPEED CHANGE CYCLES AS A FRACTION OF THE FREE FLOW COST PER 1000 KMS AT INITIAL SPEED

kph 0.3682 = idling cost per hour as a fraction of hourly cost at 8 kph

8	0.012													
16	0.027	0.014												
24	0.048	0.034	0.017											
32	0.078	0.061	0.044	0.024										
40	0.108	0.090	0.073	0.051	0.028									
48	0.142	0.125	0.106	0.085	0.061	0.032								
56	0.187	0.169	0.151	0.128	0.101	0.072	0.040							
64	0.229	0.211	0.193	0.171	0.145	0.116	0.083	0.043						
72	0.272	0.254	0.233	0.211	0.186	0.157	0.126	0.087	0.046					
80	0.315	0.298	0.280	0.257	0.232	0.205	0.174	0.136	0.095	0.050				
88	0.346	0.330	0.313	0.295	0.268	0.241	0.213	0.177	0.138	0.096	0.049			
96	0.382	0.367	0.351	0.333	0.310	0.284	0.257	0.221	0.184	0.144	0.099	0.052		
104	0.423	0.408	0.392	0.375	0.353	0.328	0.301	0.270	0.233	0.195	0.153	0.107	0.058	
112	0.471	0.455	0.442	0.425	0.405	0.381	0.357	0.325	0.292	0.256	0.217	0.172	0.126	0.072

Sources: Highway Investment Analysis Package (HIAP), US Department of Transportation, 1979
Vehicle Operating Costs, Fuel Consumption and Pavement Type and Condition Factors, US Dep of Trans, 1982

Table 5E-11

PASSENGER TIME VALUES PER VEHICLE HOUR

VEHICLE	PERSONS PER VEHICLE (1)	AVERAGE WAGE	PERCENT APPLIC.	COST PER VEH/HOUR
Car work	2.54	LE 1.90	75%	LE 3.62
Car other	2.54	1.90	30	1.45
Taxi car	4.80	0.90	60	2.59
Taxi van	8.90	0.90	60	4.81
Bus	30.50	0.25	60	4.58

(1) Car work and Car other include the driver.

Cargo value of time was taken simply as the interest cost per hour. This Study assumed a 8760 hour year and a 12 percent interest rate to derive cargo time value per ton-hour. Based on the cargo values in Appendix 5A and the average loads reported in the survey, the values per vehicle hour set out in Table 5E-12 below were adopted.

Table 5E-12

CARGO TIME VALUES PER VEHICLE HOUR

VEHICLE	AV LOAD	VALUE PER TON	COST PER TON-HOUR	COST PER VEH-HOUR
Truck single	3.5 tons	LE 340	LE 0.0050	LE 0.018
Truck comb	14.7	350	0.0050	0.074
Truck artic	12.9	315	0.0045	0.058

Toll Costs

Tolls were charged on only one road in Egypt at the time of the Study: the Alexandria Desert Road. The following toll costs applied to a trip over the entire length of approximately 200 kilometers:

Private car	LE 1	=	5 milliemes/km
Pickup	2	=	10
Bus	2	=	10
Truck single	3	=	15
Truck comb/artic	5	=	25

These are extremely low rates, representing about 5 percent of free-flow running costs. Higher rates were evaluated for the Cairo-Assuit Expressway.

VEHICLE OPERATING COST MODEL

(All costs in LE)

INPUT SELECTIONS
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Cost type	(1=E, 2=F, 3=FX)	1
Standing	(1=percent, 2=absolute)	1
Include Time Costs?	(Y=1,N=0)	0
Include Standing Costs?	(Y=1,N=0)	1
Include Interest Costs?	(Y=1,N=0)	1
Inc Depreciation Costs?	(Y=1,N=0)	1
Use Fuel Consum Factor?	(Y=1,N=0)	1
Use Oil Consum Factor?	(Y=1,N=0)	1
Use Tire Consum Factor?	(Y=1,N=0)	1
Use Spare Parts Factor?	(Y=1,N=0)	1
Use Maint Labor Factor?	(Y=1,N=0)	1
Input Vehicle Speeds?	(Y=1,N=0)	1
For Exch parts factor?	(Y=1,N=0)	1
Tariff Factors?	(Y=1,N=0)	0
Perceived Costs?	(Y=1,N=0)	0
(excl maintenance, depreciation, inter		

ROAD DESCRIPTION
****

Surface Type (1=P, 2=G, 3=E)		1
Rise plus fall	meters per km	0
Curvature	degrees per km	0
Road width	meters	7
Altitude	meters	0
Moisture	percent	0
Roughness	mm per km	2000
Rut Depth	mm	0
Surface looseness	mm	0

CALIBRATION FACTORS
****

ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Perceived costs apply?	1							
Fuel	0.77	0.87	1.00	0.59	0.67	0.76	1.76	1.54
Oil	3.78	4.56	1.00	3.43	1.74	1.81	2.39	2.39
Tires	2.10	1.61	1.00	1.61	0.92	1.20	0.74	0.63
Spare Parts	0.32	0.20	0.35	0.35	0.41	0.25	0.18	0.18
Maintenance Labor	1.00	0.78	1.00	1.50	1.60	1.25	1.43	1.35
Tariff Factor	1.00	0.90	0.90	1.00	0.90	0.90	0.90	0.90
FX parts fac (% eco)	20%	20%	20%	20%	20%	20%	20%	20%
Input Speeds	80	80	80	60	60	60	60	60

UNIT COSTS OF VEHICLES, PARTS AND LABOR (All costs in LE)

ITEM		CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
HDM Vehicle Class	- Code	1	1	2	2	5	5	5	5
	- Name	Car	Car	Lt Gds	Lt Gds	Lg Gds	Lg Gds	Lg Gds	Lg Gds
Vehicle	For X	5044	7770	9697	5544	9900	8506	28733	83300
	Eco	7265	13871	16710	14070	40815	20740	80519	125922
	Fin	6705	19660	21780	15918	42884	21520	83220	119278
Tire	For X	5	8	5	8	18	23	27	27
	Eco	54	83	54	83	182	225	267	267
	Fin	55	85	55	85	186	230	273	273
Mechanic	For X	0	0	0	0	0	0	0	0
(per hour)	Eco	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
	Fin	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Crew	For X		0.0	0.0	0.0	0.0	0.0	0.0	0.0
(per year)	Eco		4500	4500	3800	6000	4500	6000	6000
	Fin		4500	4500	3800	6000	4500	6000	6000
Passenger Time	For X								
(per pas hour)	Eco								
	Fin								
Cargo Time	For X								
(per ton hour)	Eco								
	Fin								
Fuel	For X	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Eco	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214
	Fin	0.200	0.200	0.200	0.200	0.030	0.030	0.030	0.030
Oil	For X	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Eco	1.20	1.20	1.20	1.20	0.78	0.78	0.78	0.78
	Fin	1.20	1.20	1.20	1.20	0.78	0.78	0.78	0.78
Interest Costs	For X	12%	12%	12%	12%	12%	12%	12%	12%
(%)	Eco	12%	12%	12%	12%	12%	12%	12%	12%
	Fin	12%	12%	12%	12%	12%	12%	12%	12%
Standing Costs	For X	0%	0%	0%	0%	0%	0%	0%	0%
(%)	Eco	8%	7%	7%	7%	12%	24%	17%	17%
	Fin	10%	8%	8%	8%	14%	28%	19%	19%

VEHICLE CHARACTERISTICS

ITEM		CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
HDM Vehicle Class	- Code	1	1	2	2	5	5	5	5
	- Name	Car	Car	Lt Gds	Lt Gds	Lg Gds	Lg Gds	Lg Gds	Lg Gds
Fuel (Petrol=1, Diesel=2)		1	1	1	1	2	2	2	2
Engine Power (BHP)		51	96	80	80	125	125	250	250
Unladen weight		1.0	1.0	1.2	1.5	10.0	5.0	12.5	12.5
(tons)	maximum GVW	1.5	1.9	2.7	3.5	12.0	13.0	42.5	37.5
	load factor	0.00	0.00	0.50	0.25	0.86	0.50	0.50	0.50
	average weight	1.0	1.0	2.0	2.0	11.7	9.0	27.5	25.0
Number of Passengers		2.5	5.0	9.0	2.0	30.0	1.0	1.0	1.0
Annual Driving Hours		417	1,667	1,500	1,270	2,000	1,000	1,500	1,500
Annual Kms	pvd	25000	100000	75000	70000	100000	50000	75000	75000
	unpvd								
Vehicle Life	pvd	10	7	7	7	8	10	8	8
(years)	unpvd								

OPERATING COSTS (All costs in LE) (economic) Roughness = 2000 mm/km

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ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Annual Kilometers	25000	100000	75000	70000	100000	50000	75000	75000
Vehicle Life (years)	10	7	8	7	8	15	13	8
Base Speed (kph)	60.0	60.0	50.0	55.1	50.0	50.0	50.0	50.0
Calc-paved	103.5	103.5	87.9	87.9	60.5	64.1	58.7	59.7
-unpaved	88.8	88.8	82.9	82.9	60.4	64.0	58.6	59.6
Selected	103.5	103.5	87.9	87.9	60.5	64.1	58.7	59.7
Input Speeds	80	80	80	60	60	60	60	60
Speed used	80.0	80.0	80.0	60.0	60.0	60.0	60.0	60.0
Tariff Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Mod vehicle life (yrs)	9.2	6.4	7.0	6.8	7.6	14.2	12.3	7.6
Av cumulative kms	125000	350000	300000	245000	400000	375000	487500	300000
Rev annual kms	25302	104998	80146	70836	103956	50970	77203	77203
Hours/thous kms	12.50	12.50	12.50	16.67	16.67	16.67	16.67	16.67
Fuel (liters)-paved	103.3	103.3	185.6	151.1	257.5	215.7	404.2	382.6
-unpav	115.9	115.9	187.1	149.4	279.1	236.5	426.2	404.4
-selected	79.4	89.4	185.6	89.3	172.5	164.8	711.5	588.4
Cost	17.0	19.1	39.7	19.1	36.9	35.3	152.3	125.9
Oil (liters)	4.5	5.5	1.8	6.2	7.0	7.2	9.5	9.5
Cost	5.4	6.6	2.2	7.4	5.4	5.6	7.4	7.4
Tires (number)	0.069	0.053	0.033	0.053	0.114	0.114	0.214	0.166
Cost	3.7	4.4	1.8	4.4	20.7	25.6	57.1	44.3
Parts (no of vehs)	0.0006	0.0006	0.0011	0.0011	0.0020	0.0011	0.0011	0.0006
Cost	4.6	8.9	18.6	15.7	82.0	23.7	88.2	80.7
Maint lab hours	1.4	1.7	2.2	3.3	22.0	16.1	24.0	13.9
Cost	1.3	1.6	2.1	3.1	21.1	15.5	23.0	13.4
TOTAL MAINTENANCE	5.9	10.5	20.7	18.8	103.1	39.2	111.2	94.0
Crew hours	12.5	12.5	12.5	16.7	16.7	16.7	16.7	16.7
Cost	0.0	42.9	56.1	53.6	57.7	88.3	77.7	77.7
Depreciation	31.3	20.6	29.8	29.2	52.0	28.7	84.9	215.9
Interest	17.2	7.9	12.5	11.9	23.6	24.4	62.6	97.9
DEPREC PLUS INTEREST	48.6	28.5	42.3	41.1	75.5	53.1	147.5	313.7
Running Costs	80.6	112.0	162.8	144.5	299.4	247.1	553.3	663.1
Standing Costs	6.5	7.8	11.4	10.1	35.9	59.3	94.1	112.7
Time Costs per 1000 km:								
passengers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
cargo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL COST PER 1000 KM:								
(excl time costs)	87.1	119.8	174.2	154.6	335.3	306.4	647.3	775.9
Total cost per year:	2,204	12,583	13,962	10,951	34,861	15,619	49,974	59,901
Total cost per veh-km:	0.09	0.12	0.17	0.15	0.34	0.31	0.65	0.78
Total cost per pass-km:	0.035	0.024	0.019	0.077	0.011	0.306	0.647	0.776
Total cost per ton-km:	NA	NA	0.232	0.309	0.196	0.077	0.043	0.062
Time cost per km	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SUMMARY COSTS (All costs in LE) (economic) Roughness = 2000 mm/km

ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Fuel	17.0	19.1	39.7	19.1	36.9	35.3	152.3	125.9
Oil	5.4	6.6	2.2	7.4	5.4	5.6	7.4	7.4
Tires	3.7	4.4	1.8	4.4	20.7	25.6	57.1	44.3
Spare Parts	4.6	8.9	18.6	15.7	82.0	23.7	88.2	80.7
Maint labor	1.3	1.6	2.1	3.1	21.1	15.5	23.0	13.4
Crew	0.0	42.9	56.1	53.6	57.7	88.3	77.7	77.7
Depreciation	31.3	20.6	29.8	29.2	52.0	28.7	84.9	215.9
Interest	17.2	7.9	12.5	11.9	23.6	24.4	62.6	97.9
Running Costs	80.6	112.0	162.8	144.5	299.4	247.1	553.3	663.1
Standing Costs	6.5	7.8	11.4	10.1	35.9	59.3	94.1	112.7
Passenger Time	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cargo Time	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total cost per 1000 km: (excluding time cost)	87	120	174	155	335	306	647	776
Total cost per year:	2,204	12,583	13,962	10,951	34,861	15,619	49,974	59,901
Total cost per veh-km:	0.09	0.12	0.17	0.15	0.34	0.31	0.65	0.78
Total cost per pass-km:	0.03	0.02	0.02	0.08	0.01	0.31	0.65	0.78
Total cost per ton-km:	NA	NA	0.23	0.31	0.20	0.08	0.04	0.06
Time cost per km	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PERCENTAGE COSTS Roughness = 2000 mm/km

ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Fuel	19.5%	16.0%	22.8%	12.4%	11.0%	11.5%	23.5%	16.2%
Oil	6.2%	5.5%	1.2%	4.8%	1.6%	1.8%	1.2%	1.0%
Tires	4.3%	3.7%	1.0%	2.9%	6.2%	8.4%	8.8%	5.7%
Spare Parts	5.3%	7.4%	10.7%	10.1%	24.5%	7.7%	13.6%	10.4%
Maint labor	1.5%	1.4%	1.2%	2.0%	6.3%	5.1%	3.6%	1.7%
Crew	0.0%	35.8%	32.2%	34.7%	17.2%	28.8%	12.0%	10.0%
Depreciation	36.0%	17.2%	17.1%	16.9%	15.5%	9.4%	13.1%	27.8%
Interest	19.8%	6.6%	7.2%	7.7%	7.0%	8.0%	9.7%	12.6%
Standing costs	7.4%	6.5%	6.5%	6.5%	10.7%	19.4%	14.5%	14.5%
Passenger Time	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cargo Time	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

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COSTS PER 1000 KILOMETERS BY SPEED (All costs in LE) (economic)

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(excluding time cost) Roughness = 2000 mm/km

TOTAL OPERATING COSTS

SPEED (KPH)	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
5	106.1	275.7	351.5	301.6	612.3	492.4	1033.8	1321.0
10	85.2	183.9	239.1	211.8	444.6	377.6	789.5	960.9
15	78.4	153.4	202.0	182.1	389.0	339.7	708.8	841.6
20	75.1	138.3	183.7	167.5	361.5	321.1	669.3	782.6
25	73.8	129.8	176.1	160.6	351.1	313.5	655.8	771.9
30	74.9	125.7	171.6	157.4	344.7	309.2	648.4	767.1
35	76.1	123.0	168.9	155.5	340.7	306.7	644.3	765.4
40	77.3	121.2	167.4	154.5	338.1	305.3	642.5	765.6
45	78.5	120.0	166.7	154.0	336.5	304.8	642.2	767.0
50	79.7	119.3	166.7	153.9	335.6	304.9	643.0	769.4
55	80.9	118.9	167.1	154.1	335.2	305.5	644.8	772.3
60	82.2	118.7	167.9	154.6	335.3	306.4	647.3	775.9
65	83.4	118.7	169.1	155.3	335.8	307.7	650.5	779.9
70	84.6	119.0	170.5	156.2	336.6	309.3	654.2	784.3
75	85.8	119.3	172.2	157.2	337.6	311.2	658.5	789.0
80	87.1	119.8	174.2	158.4	338.9	313.3	663.3	794.2
85	88.4	120.5	176.4	159.7	340.5	315.6	668.5	799.6
90	89.7	121.2	178.8	161.2	342.2	318.1	674.2	805.4
95	91.0	122.0	181.5	162.8	344.1	320.9	680.3	811.5
100	92.4	123.0	184.3	164.5	346.2	323.8	686.9	817.9
105	93.8	124.0	187.3	166.3	348.5	326.9	693.8	824.6
110	95.3	125.1	190.6	168.3	350.9	330.2	701.2	831.6
115	96.8	126.3	194.0	170.3	353.5	333.7	708.9	838.9
120	98.3	127.6	197.6	172.5	356.3	337.4	717.0	846.5

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VEHICLE OPERATING COST MODEL

(All costs in LE)

INPUT SELECTIONS

Cost type	(1=E, 2=F, 3=FX)	2
Standing	(1=percent, 2=absolute)	1
Include Time Costs?	(Y=1,N=0)	0
Include Standing Costs?	(Y=1,N=0)	1
Include Interest Costs?	(Y=1,N=0)	1
Inc Depreciation Costs?	(Y=1,N=0)	1
Use Fuel Consum Factor?	(Y=1,N=0)	1
Use Oil Consum Factor?	(Y=1,N=0)	1
Use Tire Consum Factor?	(Y=1,N=0)	1
Use Spare Parts Factor?	(Y=1,N=0)	1
Use Maint Labor Factor?	(Y=1,N=0)	1
Input Vehicle Speeds?	(Y=1,N=0)	1
For Exch parts factor?	(Y=1,N=0)	1
Tariff Factors?	(Y=1,N=0)	0
Perceived Costs?	(Y=1,N=0)	0
(excl maintenance, depreciation, inter		

ROAD DESCRIPTION

Surface Type (1=P, 2=G, 3=E)		1
Rise plus fall	meters per km	0
Curvature	degrees per km	0
Road width	meters	7
Altitude	meters	0
Moisture	percent	0
Roughness	mm per km	2000
Rut Depth	mm	0
Surface looseness	mm	0

CALIBRATION FACTORS

ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Perceived costs apply?	1							
Fuel	0.77	0.87	1.00	0.59	0.67	0.76	1.76	1.54
Oil	3.78	4.56	1.00	3.43	1.74	1.81	2.39	2.39
Tires	2.10	1.61	1.00	1.61	0.92	1.20	0.74	0.63
Spare Parts	0.32	0.20	0.35	0.35	0.41	0.25	0.18	0.18
Maintenance Labor	1.00	0.78	1.00	1.50	1.60	1.25	1.43	1.35
Tariff Factor	1.00	0.90	0.90	1.00	0.90	0.90	0.90	0.90
FX parts fac (% eco)	20%	20%	20%	20%	20%	20%	20%	20%
Input Speeds	80	80	80	60	60	60	60	60

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UNIT COSTS OF VEHICLES, PARTS AND LABOR (All costs in LE)

ITEM		CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
HDM Vehicle Class	- Code	1	1	2	2	5	5	5	5
	- Name	Car	Car	Lt Gds	Lt Gds	Lg Gds	Lg Gds	Lg Gds	Lg Gds
Vehicle	For X	5044	7770	9697	5544	9900	8506	28733	83300
	Eco	7265	13871	16710	14070	40815	20740	80519	125922
	Fin	6705	19660	21780	15918	42884	21520	83220	119278
Tire	For X	5	8	5	8	18	23	27	27
	Eco	54	83	54	83	182	225	267	267
	Fin	55	85	55	85	186	230	273	273
Mechanic	For X	0	0	0	0	0	0	0	0
(per hour)	Eco	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
	Fin	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Crew	For X		0.0	0.0	0.0	0.0	0.0	0.0	0.0
(per year)	Eco		4500	4500	3800	6000	4500	6000	6000
	Fin		4500	4500	3800	6000	4500	6000	6000
Passenger Time	For X								
(per pas hour)	Eco								
	Fin								
Cargo Time	For X								
(per ton hour)	Eco								
	Fin								
Fuel	For X	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Eco	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214
	Fin	0.200	0.200	0.200	0.200	0.030	0.030	0.030	0.030
Oil	For X	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Eco	1.20	1.20	1.20	1.20	0.78	0.78	0.78	0.78
	Fin	1.20	1.20	1.20	1.20	0.78	0.78	0.78	0.78
Interest Costs	For X	12%	12%	12%	12%	12%	12%	12%	12%
(%)	Eco	12%	12%	12%	12%	12%	12%	12%	12%
	Fin	12%	12%	12%	12%	12%	12%	12%	12%
Standing Costs	For X	0%	0%	0%	0%	0%	0%	0%	0%
(%)	Eco	8%	7%	7%	7%	12%	24%	17%	17%
	Fin	10%	8%	8%	8%	14%	28%	19%	19%

VEHICLE CHARACTERISTICS

ITEM		CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
HDM Vehicle Class	- Code	1	1	2	2	5	5	5	5
	- Name	Car	Car	Lt Gds	Lt Gds	Lg Gds	Lg Gds	Lg Gds	Lg Gds
Fuel (Petrol=1, Diesel=2)		1	1	1	1	2	2	2	2
Engine Power (BHP)		51	96	80	80	125	125	250	250
Unladen weight		1.0	1.0	1.2	1.5	10.0	5.0	12.5	12.5
(tons)	maximum GVW	1.5	1.9	2.7	3.5	12.0	13.0	42.5	37.5
	load factor	0.00	0.00	0.50	0.25	0.86	0.50	0.50	0.50
	average weight	1.0	1.0	2.0	2.0	11.7	9.0	27.5	25.0
Number of Passengers		2.5	5.0	9.0	2.0	30.0	1.0	1.0	1.0
Annual Driving Hours		417	1,667	1,500	1,270	2,000	1,000	1,500	1,500
Annual Kms	pvd	25000	100000	75000	70000	100000	50000	75000	75000
	unpvd								
Vehicle Life	pvd	10	7	7	7	8	10	8	8
(years)	unpvd								

OPERATING COSTS (All costs in LE) (financial) Roughness = 2000 mm/km

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ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Annual Kilometers	25000	100000	75000	70000	100000	50000	75000	75000
Vehicle Life (years)	10	7	8	7	8	15	13	8
Base Speed (kph)	60.0	60.0	50.0	55.1	50.0	50.0	50.0	50.0
Calc-paved	103.5	103.5	87.9	87.9	60.5	64.1	58.7	59.7
-unpaved	88.8	88.8	82.9	82.9	60.4	64.0	58.6	59.6
Selected	103.5	103.5	87.9	87.9	60.5	64.1	58.7	59.7
Input Speeds	80	80	80	60	60	60	60	60
Speed used	80.0	80.0	80.0	60.0	60.0	60.0	60.0	60.0
Tariff Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Mod vehicle life (yrs)	9.2	6.4	7.0	6.8	7.6	14.2	12.3	7.6
Av cumulative kms	125000	350000	300000	245000	400000	375000	487500	300000
Rev annual kms	25302	104998	80146	70836	103956	50970	77203	77203
Hours/thous kms	12.50	12.50	12.50	16.67	16.67	16.67	16.67	16.67
Fuel (liters)-paved	103.3	103.3	185.6	151.1	257.5	215.7	404.2	382.6
-unpav	115.9	115.9	187.1	149.4	279.1	236.5	426.2	404.4
-selected	79.4	89.4	185.6	89.3	172.5	164.8	711.5	588.4
Cost	15.9	17.9	37.1	17.9	5.2	4.9	21.3	17.7
Oil (liters)	4.5	5.5	1.8	6.2	7.0	7.2	9.5	9.5
Cost	5.4	6.6	2.2	7.4	5.4	5.6	7.4	7.4
Tires (number)	0.069	0.053	0.033	0.053	0.114	0.114	0.214	0.166
Cost	3.8	4.5	1.8	4.5	21.2	26.2	58.4	45.3
Parts (no of vehs)	0.0006	0.0006	0.0011	0.0011	0.0020	0.0011	0.0011	0.0006
Cost	4.2	12.6	24.3	17.7	86.2	24.6	91.2	76.4
Maint lab hours	1.4	1.7	2.2	3.3	22.0	16.1	24.0	13.9
Cost	1.3	1.6	2.1	3.1	21.1	15.5	23.0	13.4
TOTAL MAINTENANCE	5.6	14.2	26.4	20.9	107.2	40.1	114.2	89.8
Crew hours	12.5	12.5	12.5	16.7	16.7	16.7	16.7	16.7
Cost	0.0	42.9	56.1	53.6	57.7	88.3	77.7	77.7
Depreciation	28.9	29.2	38.8	33.0	54.6	29.8	87.8	204.5
Interest	15.9	11.2	16.3	13.5	24.8	25.3	64.7	92.7
DEPREC PLUS INTEREST	44.8	40.4	55.1	46.5	79.3	55.1	152.5	297.2
Running Costs	75.5	126.5	178.7	150.8	276.1	220.3	431.5	535.1
Standing Costs	7.6	10.1	14.3	12.1	38.7	61.7	82.0	101.7
Time Costs per 1000 km:								
passengers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
cargo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL COST PER 1000 KM: (excl time costs)	83.1	136.6	193.0	162.9	314.8	282.0	513.5	636.7
Total cost per year:	2,101	14,341	15,470	11,536	32,723	14,371	39,645	49,157
Total cost per veh-km:	0.08	0.14	0.19	0.16	0.31	0.28	0.51	0.64
Total cost per pass-km:	0.033	0.027	0.021	0.081	0.010	0.282	0.514	0.637
Total cost per ton-km:	NA	NA	0.257	0.326	0.184	0.070	0.034	0.051
Time cost per km	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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SUMMARY COSTS (All costs in LE) (financial) Roughness = 2000 mm/km

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ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Fuel	15.9	17.9	17.1	17.9	5.2	4.9	21.3	17.7
Oil	5.4	6.6	2.2	7.4	5.4	5.6	7.4	7.4
Tires	3.8	4.5	1.8	4.5	21.2	26.2	58.4	45.3
Spare Parts	4.2	12.6	24.3	17.7	86.2	24.6	91.2	76.4
Maint labor	1.3	1.6	2.1	3.1	21.1	15.5	23.0	13.4
Crew	0.0	42.9	56.1	53.6	57.7	88.3	77.7	77.7
Depreciation	28.9	29.2	38.8	33.0	54.6	29.8	87.8	204.5
Interest	15.9	11.2	16.3	13.5	24.8	25.3	64.7	92.7
Running Costs	75.5	126.5	178.7	150.8	276.1	220.3	431.5	535.1
Standing Costs	7.6	10.1	14.3	12.1	38.7	61.7	82.0	101.7
Passenger Time	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cargo Time	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total cost per 1000 km:								
(excluding time cost)	83	137	193	163	315	282	514	637
Total cost per year:	2,101	14,341	15,470	11,536	32,723	14,371	39,645	49,157
Total cost per veh-km:	0.08	0.14	0.19	0.16	0.31	0.28	0.51	0.64
Total cost per pass-km:	0.03	0.03	0.02	0.08	0.01	0.28	0.51	0.64
Total cost per ton-km:	NA	NA	0.26	0.33	0.18	0.07	0.03	0.05
Time cost per km	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PERCENTAGE COSTS Roughness = 2000 mm/km

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ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Fuel	19.1%	13.1%	19.2%	11.0%	1.6%	1.8%	4.2%	2.8%
Oil	6.6%	4.8%	1.1%	4.5%	1.7%	2.0%	1.5%	1.2%
Tires	4.6%	3.3%	0.9%	2.8%	6.7%	9.3%	11.4%	7.1%
Spare Parts	5.1%	9.2%	12.6%	10.9%	27.4%	8.7%	17.8%	12.0%
Maint labor	1.6%	1.2%	1.1%	1.9%	6.7%	5.5%	4.5%	2.1%
Crew	0.0%	31.4%	29.1%	32.9%	18.3%	31.3%	15.1%	12.2%
Depreciation	34.8%	21.4%	20.1%	20.3%	17.3%	10.6%	17.1%	32.1%
Interest	19.1%	8.2%	8.4%	8.3%	7.9%	9.0%	12.6%	14.6%
Standing costs	9.1%	7.4%	7.4%	7.4%	12.3%	21.9%	16.0%	16.0%
Passenger Time	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cargo Time	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

COSTS PER 1000 KILOMETERS BY SPEED (All costs in LE) (financial)

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(excluding time cost) Roughness = 2000 mm/km

TOTAL OPERATING COSTS

SPEED (KPH)	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
5	101.0	310.3	382.6	314.7	584.5	452.4	863.0	1128.9
10	81.3	207.2	262.0	221.7	424.1	350.8	649.4	809.6
15	74.8	173.0	222.1	190.8	370.7	317.0	578.3	703.3
20	71.7	156.0	202.5	175.6	344.0	300.2	542.8	650.2
25	70.5	146.5	195.0	168.6	334.3	293.5	531.6	641.6
30	71.6	142.4	190.5	165.5	328.1	289.5	524.8	637.4
35	72.7	139.7	187.9	163.7	323.9	286.8	520.6	635.4
40	73.8	137.9	186.5	162.7	320.9	285.0	517.8	634.7
45	75.0	136.8	185.8	162.2	318.7	283.8	515.9	634.7
50	76.1	136.0	185.8	162.1	317.0	282.9	514.7	635.1
55	77.2	135.6	186.2	162.4	315.8	282.3	513.9	635.8
60	78.4	135.5	187.0	162.9	314.8	282.0	513.5	636.7
65	79.5	135.5	188.1	163.5	314.0	281.7	513.4	637.7
70	80.7	135.7	189.5	164.4	313.4	281.6	513.4	638.8
75	81.9	136.1	191.1	165.4	313.0	281.6	513.6	640.0
80	83.1	136.6	193.0	166.5	312.7	281.7	514.0	641.2
85	84.3	137.2	195.1	167.8	312.5	281.8	514.5	642.4
90	85.5	137.9	197.4	169.2	312.3	282.0	515.1	643.7
95	86.8	138.7	200.0	170.7	312.3	282.2	515.8	645.0
100	88.1	139.6	202.7	172.4	312.3	282.6	516.6	646.4
105	89.4	140.6	205.5	174.1	312.3	282.9	517.5	647.7
110	90.8	141.7	208.6	176.0	312.4	283.3	518.4	649.1
115	92.2	142.8	211.8	177.9	312.6	283.7	519.4	650.5
120	93.7	144.0	215.2	180.0	312.8	284.2	520.5	652.0

VEHICLE OPERATING COST MODEL

(All costs in LE)

INPUT SELECTIONS
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Cost type	(1=E, 2=F, 3=FX)	3
Standing	(1=percent, 2=absolute)	1
Include Time Costs?	(Y=1,N=0)	0
Include Standing Costs?	(Y=1,N=0)	1
Include Interest Costs?	(Y=1,N=0)	1
Inc Depreciation Costs?	(Y=1,N=0)	1
Use Fuel Consum Factor?	(Y=1,N=0)	1
Use Oil Consum Factor?	(Y=1,N=0)	1
Use Tire Consum Factor?	(Y=1,N=0)	1
Use Spare Parts Factor?	(Y=1,N=0)	1
Use Maint Labor Factor?	(Y=1,N=0)	1
Input Vehicle Speeds?	(Y=1,N=0)	1
For Exch parts factor?	(Y=1,N=0)	1
Tariff Factors?	(Y=1,N=0)	0
Perceived Costs?	(Y=1,N=0)	0
(excl maintenance, depreciation, inter		

ROAD DESCRIPTION
****

Surface Type (1=P, 2=G, 3=E)		1
Rise plus fall	meters per km	0
Curvature	degrees per km	0
Road width	meters	7
Altitude	meters	0
Moisture	percent	0
Roughness	mm per km	2000
Rut Depth	mm	0
Surface looseness	mm	0

CALIBRATION FACTORS
****

ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Perceived costs apply?	1							
Fuel	0.77	0.87	1.00	0.59	0.67	0.76	1.76	1.54
Oil	3.78	4.56	1.00	3.43	1.74	1.81	2.39	2.39
Tires	2.10	1.61	1.00	1.61	0.92	1.20	0.74	0.63
Spare Parts	0.32	0.20	0.35	0.35	0.41	0.25	0.18	0.18
Maintenance Labor	1.00	0.78	1.00	1.50	1.60	1.25	1.43	1.35
Tariff Factor	1.00	0.90	0.90	1.00	0.90	0.90	0.90	0.90
FX parts fac (% eco)	20%	20%	20%	20%	20%	20%	20%	20%
Input Speeds	80	80	80	60	60	60	60	60

UNIT COSTS OF VEHICLES, PARTS AND LABOR (All costs in LE)

ITEM		CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
HDM Vehicle Class	- Code	1	1	2	2	5	5	5	5
	- Name	Car	Car	Lt Gds	Lt Gds	Lg Gds	Lg Gds	Lg Gds	Lg Gds
Vehicle	For X	5044	7770	9697	5544	9900	8506	28733	83300
	Eco	7265	13871	16710	14070	40815	20740	80519	125922
	Fin	6705	19660	21780	15918	42884	21520	83220	119278
Tire	For X	5	8	5	8	18	23	27	27
	Eco	54	83	54	83	182	225	267	267
	Fin	55	85	55	85	186	230	273	273
Mechanic	For X	0	0	0	0	0	0	0	0
(per hour)	Eco	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
	Fin	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Crew	For X		0.0	0.0	0.0	0.0	0.0	0.0	0.0
(per year)	Eco		4500	4500	3800	6000	4500	6000	6000
	Fin		4500	4500	3800	6000	4500	6000	6000
Passenger Time	For X								
(per pas hour)	Eco								
	Fin								
Cargo Time	For X								
(per ton hour)	Eco								
	Fin								
Fuel	For X	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Eco	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214
	Fin	0.200	0.200	0.200	0.200	0.030	0.030	0.030	0.030
Oil	For X	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Eco	1.20	1.20	1.20	1.20	0.78	0.78	0.78	0.78
	Fin	1.20	1.20	1.20	1.20	0.78	0.78	0.78	0.78
Interest Costs	For X	12%	12%	12%	12%	12%	12%	12%	12%
(%)	Eco	12%	12%	12%	12%	12%	12%	12%	12%
	Fin	12%	12%	12%	12%	12%	12%	12%	12%
Standing Costs	For X	0%	0%	0%	0%	0%	0%	0%	0%
(%)	Eco	8%	7%	7%	7%	12%	24%	17%	17%
	Fin	10%	8%	8%	8%	14%	28%	19%	19%

VEHICLE CHARACTERISTICS

ITEM		CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
HDM Vehicle Class	- Code	1	1	2	2	5	5	5	5
	- Name	Car	Car	Lt Gds	Lt Gds	Lg Gds	Lg Gds	Lg Gds	Lg Gds
Fuel (Petrol=1, Diesel=2)		1	1	1	1	2	2	2	2
Engine Power (BHP)		51	96	80	80	125	125	250	250
Unladen weight		1.0	1.0	1.2	1.5	10.0	5.0	12.5	12.5
(tons)	maximum GVW	1.5	1.9	2.7	3.5	12.0	13.0	42.5	37.5
	load factor	0.00	0.00	0.50	0.25	0.86	0.50	0.50	0.50
	average weight	1.0	1.0	2.0	2.0	11.7	9.0	27.5	25.0
Number of Passengers		2.5	5.0	9.0	2.0	30.0	1.0	1.0	1.0
Annual Driving Hours		417	1,667	1,500	1,270	2,000	1,000	1,500	1,500
Annual Kms	pvd	25000	100000	75000	70000	100000	50000	75000	75000
	unpvd								
Vehicle Life	pvd	10	7	7	7	8	10	8	8
(years)	unpvd								

OPERATING COSTS (All costs in LE) (for exch) Roughness = 2000 mm/km

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ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Annual Kilometers	25000	100000	75000	70000	100000	50000	75000	75000
Vehicle Life (years)	10	7	8	7	8	15	13	8
Base Speed (kph)	60.0	60.0	50.0	55.1	50.0	50.0	50.0	50.0
Calc-paved	103.5	103.5	87.9	87.9	60.5	64.1	58.7	59.7
-unpaved	88.8	88.8	82.9	82.9	60.4	64.0	58.6	59.6
Selected	103.5	103.5	87.9	87.9	60.5	64.1	58.7	59.7
input Speeds	80	80	80	60	60	60	60	60
Speed used	80.0	80.0	80.0	60.0	60.0	60.0	60.0	60.0
Tariff Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Mod vehicle life (yrs)	9.2	6.4	7.0	6.8	7.6	14.2	12.3	7.6
Av cumulative kms	125000	350000	300000	245000	400000	375000	487500	300000
Rev annual kms	25302	104998	80146	70836	103956	50970	77203	77203
Hours/thous kms	12.50	12.50	12.50	16.67	16.67	16.67	16.67	16.67
Fuel (liters)-paved	103.3	103.3	185.6	151.1	257.5	215.7	404.2	382.6
-unpav	115.9	115.9	187.1	149.4	279.1	236.5	426.2	404.4
-selected	79.4	89.4	185.6	89.3	172.5	164.8	711.5	588.4
Cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oil (liters)	4.5	5.5	1.8	6.2	7.0	7.2	9.5	9.5
Cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tires (number)	0.069	0.053	0.033	0.053	0.114	0.114	0.214	0.166
Cost	0.3	0.4	0.2	0.4	2.1	2.6	5.8	4.5
Parts (no of vehs)	0.0006	0.0006	0.0011	0.0011	0.0020	0.0011	0.0011	0.0006
Cost	0.8	2.5	4.9	3.5	17.2	4.9	18.2	15.3
Maint lab hours	1.4	1.7	2.2	3.3	22.0	16.1	24.0	13.9
Cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL MAINTENANCE	0.8	2.5	4.9	3.5	17.2	4.9	18.2	15.3
Crew hours	12.5	12.5	12.5	16.7	16.7	16.7	16.7	16.7
Cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depreciation	21.8	11.5	17.3	11.5	12.6	11.8	30.3	142.8
Interest	12.0	4.4	7.3	4.7	5.7	10.0	22.3	64.7
DEPREC PLUS INTEREST	33.7	16.0	24.5	16.2	18.3	21.8	52.6	207.5
Running Costs	34.9	18.9	29.6	20.2	37.6	29.3	76.7	227.3
Standing Costs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time Costs per 1000 km:								
passengers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
cargo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL COST PER 1000 KM: (excl time costs)	34.9	18.9	29.6	20.2	37.6	29.3	76.7	227.3
Total cost per year:	883	1,986	2,369	1,428	3,909	1,495	5,918	17,548
Total cost per veh-km:	0.03	0.02	0.03	0.02	0.04	0.03	0.08	0.23
Total cost per pass-km:	0.014	0.004	0.003	0.010	0.001	0.029	0.077	0.227
Total cost per ton-km:	NA	NA	0.039	0.040	0.022	0.007	0.005	0.018
Time cost per km	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SUMMARY COSTS (All costs in LE) (for exch) Roughness = 2000 mm/km

ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Fuel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tires	0.3	0.4	0.2	0.4	2.1	2.6	5.8	4.5
Spare Parts	0.8	2.5	4.9	3.5	17.2	4.9	18.2	15.3
Maint labor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crew	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depreciation	21.8	11.5	17.3	11.5	12.6	11.8	30.3	142.8
Interest	12.0	4.4	7.3	4.7	5.7	10.[illegible]	22.3	64.7
Running Costs	34.9	18.9	29.6	20.2	37.6	29.3	76.7	227.3
Standing Costs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Passenger Time	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cargo Time	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total cost per 1000 km:								
(excluding time cost)	35	19	30	20	38	29	77	227
Total cost per year:	883	1,986	2,369	1,428	3,909	1,495	5,918	17,548
Total cost per veh-km:	0.03	0.02	0.03	0.02	0.04	0.03	0.08	0.23
Total cost per pass-km:	0.01	0.00	0.00	0.01	0.00	0.03	0.08	0.23
Total cost per ton-km:	NA	NA	0.04	0.04	0.02	0.01	0.01	0.02
Time cost per km	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PERCENTAGE COSTS Roughness = 2000 mm/km

ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Fuel	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Oil	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Tires	1.0%	2.3%	0.6%	2.1%	5.5%	8.9%	7.5%	2.0%
Spare Parts	2.4%	13.3%	16.4%	17.6%	45.8%	16.8%	23.8%	6.7%
Maint labor	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Crew	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Depreciation	62.3%	61.0%	58.5%	57.0%	33.5%	40.2%	39.5%	62.8%
Interest	34.3%	23.5%	24.6%	23.3%	15.2%	34.1%	29.1%	28.5%
Standing costs	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Passenger Time	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cargo Time	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

COSTS PER 1000 KILOMETERS BY SPEED (All costs in LE) (for exch)

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(excluding time cost) Roughness = 2000 mm/km

TOTAL OPERATING COSTS

SPEED (KPH)	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
5	40.1	40.3	52.1	34.1	62.6	43.6	132.3	424.3
10	32.8	26.5	36.2	24.3	46.4	33.4	95.8	288.0
15	30.4	21.9	31.0	21.0	41.0	30.0	83.7	242.6
20	29.2	19.6	28.3	19.4	38.3	28.4	77.6	219.8
25	28.8	18.4	28.3	19.0	38.0	28.4	76.8	219.8
30	29.7	18.4	28.4	19.2	37.8	28.5	76.5	220.6
35	30.6	18.4	28.5	19.4	37.7	28.7	76.4	221.7
40	31.3	18.5	28.7	19.6	37.6	28.8	76.3	222.9
45	31.9	18.5	28.8	19.7	37.6	29.0	76.4	224.1
50	32.5	18.6	28.9	19.9	37.6	29.1	76.5	225.2
55	33.0	18.6	29.1	20.0	37.6	29.2	76.6	226.3
60	33.5	18.7	29.2	20.2	37.6	29.3	76.7	227.3
65	33.9	18.8	29.3	20.3	37.6	29.4	76.8	228.2
70	34.3	18.8	29.4	20.4	37.6	29.5	76.8	229.1
75	34.6	18.9	29.5	20.5	37.6	29.6	76.9	229.9
80	34.9	18.9	29.6	20.6	37.6	29.7	77.0	230.6
85	35.2	19.0	29.6	20.6	37.7	29.8	77.1	231.3
90	35.4	19.0	29.7	20.7	37.7	29.9	77.2	231.9
95	35.7	19.0	29.8	20.8	37.7	29.9	77.3	232.5
100	35.9	19.1	29.8	20.9	37.7	30.0	77.4	233.0
105	36.1	19.1	29.9	20.9	37.7	30.1	77.4	233.5
110	36.3	19.2	30.0	21.0	37.7	30.1	77.5	234.0
115	36.5	19.2	30.0	21.0	37.7	30.2	77.6	234.5
120	36.7	19.2	30.1	21.1	37.8	30.2	77.6	234.9

VEHICLE OPERATING COST MODEL

(All costs in LE)

INPUT SELECTIONS
****

Cost type	(1=E, 2=F, 3=FX)	2
Standing	(1=percent, 2=absolute)	1
Include Time Costs?	(Y=1,N=0)	0
Include Standing Costs?	(Y=1,N=0)	1
Include Interest Costs?	(Y=1,N=0)	1
Inc Depreciation Costs?	(Y=1,N=0)	1
Use Fuel Consum Factor?	(Y=1,N=0)	1
Use Oil Consum Factor?	(Y=1,N=0)	1
Use Tire Consum Factor?	(Y=1,N=0)	1
Use Spare Parts Factor?	(Y=1,N=0)	1
Use Maint Labor Factor?	(Y=1,N=0)	1
Input Vehicle Speeds?	(Y=1,N=0)	1
For Exch parts factor?	(Y=1,N=0)	1
Tariff Factors?	(Y=1,N=0)	1
Perceived Costs?	(Y=1,N=0)	1
(excl maintenance, depreciation, inter		

ROAD DESCRIPTION
****

Surface Type (1=P, 2=G, 3=E)		1
Rise plus fall	meters per km	0
Curvature	degrees per km	0
Road width	meters	7
Altitude	meters	0
Moisture	percent	0
Roughness	mm per km	2000
Rut Depth	mm	0
Surface looseness	mm	0

CALIBRATION FACTORS
****

ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Perceived costs apply?	1							
Fuel	0.77	0.87	1.00	0.59	0.67	0.76	1.76	1.54
Oil	3.78	4.56	1.00	3.43	1.74	1.81	2.39	2.39
Tires	2.10	1.61	1.00	1.61	0.92	1.20	0.74	0.63
Spare Parts	0.32	0.20	0.35	0.35	0.41	0.25	0.18	0.18
Maintenance Labor	1.00	0.78	1.00	1.50	1.60	1.25	1.43	1.35
Tariff Factor	1.00	0.90	0.90	1.00	0.90	0.90	0.90	0.90
FX parts fac (% eco)	20%	20%	20%	20%	20%	20%	20%	20%
Input Speeds	80	80	80	60	60	60	60	60

UNIT COSTS OF VEHICLES, PARTS AND LABOR (All costs in LE)

ITEM		CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
HDM Vehicle Class	- Code	1	1	2	2	5	5	5	5
	- Name	Car	Car	Lt Gds	Lt Gds	Lg Gds	Lg Gds	Lg Gds	Lg Gds
Vehicle	For X	5044	7770	9697	5544	9900	8506	28733	83300
	Eco	7265	13871	16710	14070	40815	20740	80519	125922
	Fin	6705	19660	21780	15918	42884	21520	83220	119278
Tire	For X	5	8	5	8	18	23	27	27
	Eco	54	83	54	83	182	225	267	267
	Fin	55	85	55	85	186	230	273	273
Mechanic	For X	0	0	0	0	0	0	0	0
(per hour)	Eco	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
	Fin	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Crew	For X		0.0	0.0	0.0	0.0	0.0	0.0	0.0
(per year)	Eco		4500	4500	3800	6000	4500	6000	6000
	Fin		4500	4500	3800	6000	4500	6000	6000
Passenger Time	For X								
(per pas hour)	Eco								
	Fin								
Cargo Time	For X								
(per ton hour)	Eco								
	Fin								
Fuel	For X	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Eco	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214
	Fin	0.200	0.200	0.200	0.200	0.030	0.030	0.030	0.030
Oil	For X	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Eco	1.20	1.20	1.20	1.20	0.78	0.78	0.78	0.78
	Fin	1.20	1.20	1.20	1.20	0.78	0.78	0.78	0.78
Interest Costs	For X	12%	12%	12%	12%	12%	12%	12%	12%
(%)	Eco	12%	12%	12%	12%	12%	12%	12%	12%
	Fin	12%	12%	12%	12%	12%	12%	12%	12%
Standing Costs	For X	0%	0%	0%	0%	0%	0%	0%	0%
(%)	Eco	8%	7%	7%	7%	12%	24%	17%	17%
	Fin	10%	8%	8%	8%	14%	28%	19%	19%

VEHICLE CHARACTERISTICS

ITEM		CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
HDM Vehicle Class	- Code	1	1	2	2	5	5	5	5
	- Name	Car	Car	Lt Gds	Lt Gds	Lg Gds	Lg Gds	Lg Gds	Lg Gds
Fuel (Petrol=1, Diesel=2)		1	1	1	1	2	2	2	2
Engine Power (BHP)		51	96	80	80	125	125	250	250
Unladen weight		1.0	1.0	1.2	1.5	10.0	5.0	12.5	12.5
(tons)	maximum GVW	1.5	1.9	2.7	3.5	12.0	13.0	42.5	37.5
	load factor	0.00	0.00	0.50	0.25	0.86	0.50	0.50	0.50
	average weight	1.0	1.0	2.0	2.0	11.7	9.0	27.5	25.0
Number of Passengers		2.5	5.0	9.0	2.0	30.0	1.0	1.0	1.0
Annual Driving Hours		417	1,667	1,500	1,270	2,000	1,000	1,500	1,500
Annual Kms	pvd	25000	100000	75000	70000	100000	50000	75000	75000
	unpvd								
Vehicle Life	pvd	10	7	7	7	8	10	8	8
(years)	unpvd								

OPERATING COSTS (All costs in LE) (fin perc) Roughness = 2000 mm/km

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ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Annual Kilometers	25000	100000	75000	70000	100000	50000	75000	75000
Vehicle Life (years)	10	7	8	7	8	15	13	8
Base Speed (kph)	60.0	60.0	50.0	55.1	50.0	50.0	50.0	50.0
Calc-paved	103.5	103.5	87.9	87.9	60.5	64.1	58.7	59.7
-unpaved	88.8	88.8	82.9	82.9	60.4	64.0	58.6	59.6
Selected	103.5	103.5	87.9	87.9	60.5	64.1	58.7	59.7
Input Speeds	80	80	80	60	60	60	60	60
Speed used	80.0	80.0	80.0	60.0	60.0	60.0	60.0	60.0
Tariff Factor	1.0	0.9	0.9	1.0	0.9	0.9	0.9	0.9
Mod vehicle life (yrs)	9.2	6.4	7.0	6.8	7.6	14.2	12.3	7.6
Av cumulative kms	125000	350000	300000	245000	400000	375000	487500	300000
Rev annual kms	25302	104998	80146	70836	103956	50970	77203	77203
Hours/thous kms	12.50	12.50	12.50	16.67	16.67	16.67	16.67	16.67
Fuel (liters)-paved	103.3	103.3	185.6	151.1	257.5	215.7	404.2	382.6
-unpav	115.9	115.9	187.1	149.4	279.1	236.5	426.2	404.4
-selected	79.4	89.4	185.6	89.3	172.5	164.8	711.5	588.4
Cost	15.9	16.1	33.4	17.9	4.7	4.4	19.2	15.9
Oil (liters)	4.5	5.5	1.8	6.2	7.0	7.2	9.5	9.5
Cost	5.4	5.9	1.9	7.4	4.9	5.1	6.7	6.7
Tires (number)	0.069	0.053	0.033	0.053	0.114	0.114	0.214	0.166
Cost	3.8	4.1	1.6	4.5	19.1	23.6	52.5	40.8
Parts (no of vehs)	0.0006	0.0006	0.0011	0.0011	0.0020	0.0011	0.0011	0.0006
Cost	4.2	11.3	21.8	17.7	77.6	22.2	82.1	68.8
Maint lab hours	1.4	1.7	2.2	3.3	22.0	16.1	24.0	13.9
Cost	1.3	1.5	1.9	3.1	19.0	13.9	20.7	12.0
TOTAL MAINTENANCE	0.0	12.8	23.7	20.9	96.5	36.1	102.8	80.8
Crew hours	12.5	12.5	12.5	16.7	16.7	16.7	16.7	16.7
Cost	0.0	38.6	50.5	53.6	51.9	79.5	69.9	69.9
Depreciation	28.9	26.3	34.9	33.0	49.1	26.8	79.0	184.0
Interest	15.9	10.1	14.7	13.5	22.3	22.8	58.2	83.4
DEPREC PLUS INTEREST	0.0	36.4	49.6	46.5	71.4	49.6	137.2	267.5
Running Costs	25.1	113.8	160.9	150.8	248.5	198.2	388.4	481.6
Standing Costs	2.5	9.1	12.9	12.1	34.8	55.5	73.8	91.5
Time Costs per 1000 km:								
passengers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
cargo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL COST PER 1000 KM:								
(excl time costs)	27.6	122.9	173.7	162.9	283.3	253.8	462.2	573.1
Total cost per year:	699	12,907	13,923	11,536	29,451	12,934	35,680	44,242
Total cost per veh-km:	0.03	0.12	0.17	0.16	0.28	0.25	0.46	0.57
Total cost per pass-km:	0.011	0.025	0.019	0.081	0.009	0.254	0.462	0.573
Total cost per ton-km:	NA	NA	0.232	0.326	0.165	0.063	0.031	0.046
Time cost per km	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SUMMARY COSTS (All costs in LE) (fin perc) Roughness = 2000 mm/km

****

ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Fuel	15.9	16.1	33.4	17.9	4.7	4.4	19.2	15.9
Oil	5.4	5.9	1.9	7.4	4.9	5.1	6.7	6.7
Tires	3.8	4.1	1.6	4.5	19.1	23.6	52.5	40.8
Spare Parts	0.0	11.3	21.8	17.7	77.6	22.2	82.1	68.8
Maint labor	0.0	1.5	1.9	3.1	19.0	13.9	20.7	12.0
Crew	0.0	38.6	50.5	53.6	51.9	79.5	69.9	69.9
Depreciation	0.0	26.3	34.9	33.0	49.1	26.8	79.0	184.0
Interest	0.0	10.1	14.7	13.5	22.3	22.8	58.2	83.4
Running Costs	25.1	113.8	160.9	150.8	248.5	198.2	388.4	481.6
Standing Costs	2.5	9.1	12.9	12.1	34.8	55.5	73.8	91.5
Passenger Time	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cargo Time	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total cost per 1000 km: (excluding time cost)	28	123	174	163	283	254	462	573
Total cost per year:	699	12,907	13,923	11,536	29,451	12,934	35,680	44,242
Total cost per veh-km:	0.03	0.12	0.17	0.16	0.28	0.25	0.46	0.57
Total cost per pass-km:	0.01	0.02	0.02	0.08	0.01	0.25	0.46	0.57
Total cost per ton-km:	NA	NA	0.23	0.33	0.17	0.06	0.03	0.05
Time cost per km	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PERCENTAGE COSTS Roughness = 2000 mm/km

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ITEM	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
Fuel	57.5%	13.1%	19.2%	11.0%	1.6%	1.8%	4.2%	2.8%
Oil	19.7%	4.8%	1.1%	4.5%	1.7%	2.0%	1.5%	1.2%
Tires	13.8%	3.3%	0.9%	2.8%	6.7%	9.3%	11.4%	7.1%
Spare Parts	0.0%	9.2%	12.6%	10.9%	27.4%	8.7%	17.8%	12.0%
Maint labor	0.0%	1.2%	1.1%	1.9%	6.7%	5.5%	4.5%	2.1%
Crew	0.0%	31.4%	29.1%	32.9%	18.3%	31.3%	15.1%	12.2%
Depreciation	0.0%	21.4%	20.1%	20.3%	17.3%	10.6%	17.1%	32.1%
Interest	0.0%	8.2%	8.4%	8.3%	7.9%	9.0%	12.6%	14.6%
Standing costs	9.1%	7.4%	7.4%	7.4%	12.3%	21.9%	16.0%	16.0%
Passenger Time	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cargo Time	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

COSTS PER 1000 KILOMETERS BY SPEED (All costs in LE) (fin perc)

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(excluding time cost) Roughness = 2000 mm/km

TOTAL OPERATING COSTS

SPEED (KPH)	CAR	TAXI-C	TAXI-V	PICK-U	BUS	TRK-S	TRK-C	TRK-A
5	38.0	279.3	344.3	314.7	526.0	407.1	776.7	1016.0
10	28.9	186.5	235.8	221.7	381.7	315.7	584.4	728.7
15	26.0	155.7	199.9	190.8	333.6	285.3	520.4	633.0
20	24.7	140.4	182.3	175.6	309.6	270.2	488.5	585.2
25	24.0	131.9	175.5	168.6	300.9	264.2	478.4	577.4
30	23.7	128.2	171.5	165.5	295.3	260.5	472.4	573.6
35	23.6	125.7	169.1	163.7	291.5	258.1	468.5	571.9
40	23.7	124.1	167.8	162.7	288.8	256.5	466.0	571.2
45	23.9	123.1	167.2	162.2	286.8	255.4	464.3	571.2
50	24.2	122.4	167.2	162.1	285.3	254.6	463.2	571.6
55	24.6	122.1	167.6	162.4	284.2	254.1	462.5	572.3
60	25.1	121.9	168.3	162.9	283.3	253.8	462.2	573.1
65	25.6	122.0	169.3	163.5	282.6	253.5	462.0	574.0
70	26.2	122.2	170.5	164.4	282.1	253.4	462.1	575.0
75	26.9	122.5	172.0	165.4	281.7	253.4	462.3	576.0
80	27.6	122.9	173.7	166.5	281.4	253.5	462.6	577.1
85	28.5	123.5	175.6	167.8	281.2	253.6	463.1	578.2
90	29.3	124.1	177.7	169.2	281.1	253.8	463.6	579.3
95	30.2	124.8	180.0	170.7	281.0	254.0	464.2	580.5
100	31.2	125.7	182.4	172.4	281.0	254.3	464.9	581.7
105	32.3	126.5	185.0	174.1	281.1	254.6	465.7	582.9
110	33.4	127.5	187.7	176.0	281.2	255.0	466.6	584.2
115	34.5	128.5	190.7	177.9	281.3	255.3	467.5	585.5
120	35.7	129.6	193.7	180.0	281.5	255.8	468.5	586.8

EXCESS HOURS CONSUMED PER 1000 SPEED CHANGE CYCLES
CAR AND TAXI (HIAP 4 KIP)

INITIAL RUNNING SPEED	SPEED REDUCED TO AND RETURNED FROM, KPH													
	STOP	8	16	24	32	40	48	56	64	72	80	88	96	104
kph														
8	1.02													
16	1.51	0.62												
24	2.00	1.12	0.46											
32	2.49	1.62	0.93	0.35										
40	2.98	2.11	1.40	0.80	0.28									
48	3.46	2.60	1.87	1.24	0.70	0.23								
56	3.94	3.09	2.34	1.69	1.11	0.60	0.19							
64	4.42	3.58	2.81	2.13	1.52	0.97	0.51	0.16						
72	4.90	4.06	3.28	2.57	1.93	1.34	0.83	0.42	0.13					
80	5.37	4.54	3.75	3.01	2.34	1.71	1.15	0.68	0.35	0.11				
88	5.84	5.02	4.21	3.45	2.74	2.08	1.47	0.94	0.57	0.28	0.09			
96	6.31	5.50	4.67	3.88	3.14	2.44	1.78	1.20	0.78	0.45	0.21	0.07		
104	6.78	5.97	5.13	4.31	3.54	2.80	2.09	1.45	0.99	0.62	0.36	0.18	0.05	
112	7.25	6.44	5.58	4.74	3.94	3.16	2.40	1.70	1.19	0.78	0.50	0.30	0.16	0.04

EXCESS HOURS CONSUMED PER 1000 SPEED CHANGE CYCLES
TAXI VAN AND PICKUP (HIAP 5 KIP)

INITIAL RUNNING SPEED	SPEED REDUCED TO AND RETURNED FROM, KPH													
	STOP	8	16	24	32	40	48	56	64	72	80	88	96	104
kph														
8	0.73													
16	1.12	0.58												
24	1.52	0.98	0.47											
32	1.93	1.37	0.86	0.41										
40	2.36	1.77	1.24	0.76	0.35									
48	2.81	2.20	1.63	1.13	0.68	0.30								
56	3.28	2.64	2.05	1.52	1.04	0.62	0.27							
64	3.78	3.11	2.50	1.93	1.42	0.96	0.57	0.25						
72	4.30	3.62	2.96	2.36	1.81	1.32	0.89	0.53	0.24					
80	4.87	4.16	3.48	2.84	2.26	1.73	1.26	0.84	0.49	0.22				
88	5.48	4.75	4.04	3.37	2.74	2.16	1.64	1.18	0.79	0.47	0.22			
96	6.15	5.40	4.67	3.96	3.28	2.65	2.07	1.56	1.11	0.73	0.43	0.21		
104	6.90	6.15	5.40	4.67	3.97	3.30	2.67	2.10	1.57	1.12	0.72	0.41	0.21	
112	7.75	6.99	6.23	5.45	4.73	4.01	3.25	2.66	2.04	1.57	1.06	0.70	0.38	0.20

EXCESS HOURS CONSUMED PER 1000 SPEED CHANGE CYCLES
BUS AND SINGLE TRUCK (HIAP 40 KIP)

INITIAL RUNNING SPEED	SPEED REDUCED TO AND RETURNED FROM, KPH													
	STOP	8	16	24	32	40	48	56	64	72	80	88	96	104
kph														
8	0.67													
16	1.47	0.61												
24	2.30	1.34	0.55											
32	3.19	2.08	1.19	0.50										
40	4.16	2.97	1.95	1.12	0.47									
48	5.22	3.98	2.85	1.88	1.07	0.44								
56	6.41	5.14	3.94	2.84	1.88	1.07	0.44							
64	7.76	6.48	5.24	4.05	2.96	1.98	1.16	0.49						
72	9.35	8.07	6.80	5.57	4.37	3.25	2.21	1.31	0.57					
80	11.74	10.02	8.70	7.40	6.12	4.88	3.72	2.64	1.66	0.78				
88	13.94	12.52	11.12	9.74	8.38	7.05	5.76	4.50	3.30	2.14	1.04			
96	17.47	15.87	14.29	12.73	11.18	9.67	8.18	6.73	5.30	3.91	2.56	1.26		
104	20.90	19.30	17.60	15.80	13.80	12.20	10.60	8.80	7.20	5.70	4.00	2.20	0.60	
112	24.40	22.60	20.80	18.70	16.40	14.80	13.20	11.00	9.10	7.60	5.60	3.70	1.80	0.10

EXCESS HOURS CONSUMED PER 1000 SPEED CHANGE CYCLES
COMBINATION AND ARTICULATED TRUCKS (HIAP 50 KIP)

INITIAL RUNNING SPEED	SPEED REDUCED TO AND RETURNED FROM, KPH													
	STOP	8	16	24	32	40	48	56	64	72	80	88	96	104
kph														
8	1.10													
16	2.27	0.95												
24	3.48	1.96	0.81											
32	4.76	3.05	1.71	0.69										
40	6.10	4.25	2.72	1.49	0.60									
48	7.56	5.59	3.90	2.45	1.36	0.54								
56	9.19	7.12	5.29	3.66	2.35	1.31	0.52							
64	11.09	8.94	6.99	5.20	3.66	2.40	1.36	0.58						
72	13.39	11.20	9.12	7.19	5.45	3.95	2.65	1.58	0.71					
80	16.37	14.13	11.95	9.88	7.95	6.19	4.60	3.18	1.95	0.89				
88	20.72	18.33	15.98	13.71	11.53	9.45	7.48	5.66	3.98	2.48	1.15			
96	27.94	24.99	22.10	19.28	16.55	13.93	11.44	9.10	6.92	4.92	3.10	1.46		
104	36.00	32.00	27.60	24.80	21.60	18.80	15.30	12.50	10.00	7.20	5.20	3.20	1.30	
112	44.00	38.60	33.20	30.50	26.60	23.30	19.20	15.80	12.90	9.80	7.00	4.90	2.90	0.80

EXCESS COST OF 1000 SPEED CHANGE CYCLES (FRACTION OF FREE FLOW COST PER 1000 KMS AT INITIAL
INIT CAR AND TAXI (HIAP 4 KIP)

RUN SPD	STOP	8	16	24	32	40	48	56	64	72	80	88	96	104
	SPEED REDUCED TO AND RETURNED FROM, KPH													
kph	0.3682 = IDLING COST PER HOUR AS FRACTION OF HOURLY COST AT 8 KPH													
8	0.012													
16	0.027	0.014												
24	0.048	0.034	0.017											
32	0.078	0.061	0.044	0.024										
40	0.108	0.090	0.073	0.051	0.028									
48	0.142	0.125	0.106	0.085	0.061	0.032								
56	0.187	0.169	0.151	0.128	0.101	0.072	0.040							
64	0.229	0.211	0.193	0.171	0.145	0.116	0.083	0.043						
72	0.272	0.254	0.233	0.211	0.186	0.157	0.126	0.087	0.046					
80	0.315	0.298	0.280	0.257	0.232	0.205	0.174	0.136	0.095	0.050				
88	0.346	0.330	0.313	0.295	0.268	0.241	0.213	0.177	0.138	0.096	0.049			
96	0.382	0.367	0.351	0.333	0.310	0.284	0.257	0.221	0.184	0.144	0.099	0.052		
104	0.423	0.408	0.392	0.375	0.353	0.328	0.301	0.270	0.233	0.195	0.153	0.107	0.058	
112	0.471	0.455	0.442	0.425	0.405	0.381	0.357	0.325	0.292	0.256	0.217	0.172	0.126	0.072

EXCESS COST OF 1000 SPEED CHANGE CYCLES (FRACTION OF FREE FLOW COST PER 1000 KMS AT INITIAL
INIT TAXI VAN AND PICKUP (HIAP 5 KIP)

RUNNING SPEED	STOP	8	16	24	32	40	48	56	64	72	80	88	96	104
	SPEED REDUCED TO AND RETURNED FROM, KPH													
kph	0.3905 = IDLING COST PER HOUR AS FRACTION OF HOURLY COST AT 8 KPH													
8	0.014													
16	0.033	0.017												
24	0.061	0.042	0.023											
32	0.101	0.081	0.058	0.031										
40	0.136	0.116	0.093	0.068	0.035									
48	0.175	0.154	0.132	0.107	0.074	0.039								
56	0.220	0.200	0.177	0.153	0.121	0.086	0.046							
64	0.264	0.245	0.222	0.198	0.169	0.134	0.095	0.050						
72	0.303	0.284	0.263	0.239	0.210	0.178	0.142	0.098	0.052					
80	0.342	0.325	0.303	0.281	0.255	0.222	0.188	0.146	0.101	0.053				
88	0.388	0.371	0.353	0.331	0.303	0.274	0.239	0.200	0.156	0.109	0.058			
96	0.439	0.424	0.405	0.385	0.360	0.330	0.296	0.260	0.217	0.172	0.124	0.068		
104	0.471	0.456	0.439	0.421	0.398	0.372	0.343	0.309	0.268	0.229	0.185	0.135	0.074	
112	0.529	0.516	0.502	0.484	0.463	0.441	0.413	0.382	0.348	0.311	0.272	0.225	0.168	0.102

EXCESS COST OF 1000 SPEED CHANGE CYCLES (FRACTION OF FREE FLOW COST PER 1000 KMS AT INITIAL
BUS AND SINGLE TRUCK (HIAP 40 KIP)

INIT RUNNING SPEED	STOP	SPEED REDUCED TO AND RETURNED FROM, KPH 8	16	24	32	40	48	56	64	72	80	88	96	104
kph	0.2223 = IDLING COST PER HOUR AS FRACTION OF HOURLY COST AT 8 KPH													
8	0.017													
16	0.046	0.026												
24	0.091	0.069	0.039											
32	0.155	0.130	0.098	0.055										
40	0.236	0.210	0.177	0.131	0.072									
48	0.342	0.315	0.279	0.231	0.169	0.093								
56	0.447	0.418	0.382	0.333	0.270	0.191	0.095							
64	0.564	0.531	0.497	0.451	0.384	0.305	0.208	0.112						
72	0.698	0.669	0.631	0.580	0.521	0.440	0.342	0.245	0.131					
80	0.840	0.810	0.773	0.722	0.655	0.584	0.487	0.389	0.276	0.146				
88	0.968	0.944	0.907	0.862	0.792	0.718	0.624	0.529	0.418	0.293	0.150			
96	1.099	1.079	1.039	0.994	0.930	0.854	0.766	0.670	0.569	0.441	0.300	0.154		
104	1.209	1.182	1.151	1.101	1.044	0.967	0.882	0.794	0.691	0.572	0.441	0.300	0.153	
112	1.319	1.296	1.259	1.219	1.163	1.093	0.785	0.919	0.819	0.704	0.578	0.444	0.300	0.153

EXCESS COST OF 1000 SPEED CHANGE CYCLES (FRACTION OF FREE FLOW COST PER 1000 KMS AT INITIAL
COMBINATION AND ARTICULATED TRUCKS (HIAP 50 KIP)

INIT RUNNING SPEED	STOP	SPEED REDUCED TO AND RETURNED FROM, KPH 8	16	24	32	40	48	56	64	72	80	88	96	104
kph	0.2427 = IDLING COST PER HOUR AS FRACTION OF HOURLY COST AT 8 KPH													
5	0.027													
10	0.081	0.046												
15	0.176	0.134	0.078											
20	0.346	0.292	0.222	0.126										
25	0.505	0.452	0.380	0.283	0.153									
30	0.682	0.631	0.560	0.460	0.332	0.179								
35	0.842	0.791	0.720	0.622	0.501	0.344	0.167							
40	1.013	0.963	0.894	0.802	0.669	0.527	0.351	0.187						
45	1.214	1.164	1.100	1.005	0.877	0.732	0.559	0.396	0.210					
50	1.397	1.353	1.287	1.199	1.075	0.934	0.767	0.613	0.428	0.223				
55	1.566	1.524	1.456	1.368	1.254	1.119	0.958	0.806	0.633	0.435	0.224			
60	1.739	1.698	1.633	1.551	1.433	1.306	1.147	1.004	0.837	0.649	0.441	0.224		
65	1.897	1.858	1.800	1.713	1.612	1.479	1.330	1.189	1.037	0.853	0.657	0.446	0.230	
70	2.032	1.991	1.935	1.857	1.760	1.637	1.496	1.358	1.209	1.034	0.845	0.647	0.447	0.226