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والنقل البحرى

MINISTRY OF TRANSPORT AND COMMUNICATION
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هيئة الطرق والكبارى

ROADS AND BRIDGES AUTHORITY

دراسة الجدوى لمشروع طريق القاهرة - أسيوط

CAIRO-ASSUIT HIGHWAY FEASIBILITY STUDY

FINAL REPORT

Appendix Volume 2

EXISTING TRANSPORT CHARACTERISTICS

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بواسطة
ويلبر سميث وشركاه
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FORWARD

This volume of appendices to the Final Report describes the characteristics of transport in the corridor. Most of the information reported was derived from the extensive surveys conducted by the Study which were reported in Appendix Volume 1. Other sources of data were also used, particularly for the assessments of non-highway modes of transport.

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1986 HIGHWAY TRAFFIC VOLUMES

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Appendix 2A

1986 HIGHWAY TRAFFIC VOLUMES

This Appendix reviews the major characteristics of highway traffic as derived from the traffic count and journey time surveys.

The major characteristics covered in this appendix are as follows:

- Traffic Volumes
- Traffic Composition
- Hourly Traffic Variation
- Daily Traffic Variation
- Passenger Car Equivalents
- Traffic Speeds

Traffic Volumes

The volumes of traffic counted at each of the stations in the Roadside Interview and Manual Traffic Count Survey are shown in Table 2A-1. Estimates are included in terms of equivalent passenger car units (PCUs) which are discussed in more detail below. Total traffic volumes are shown on the map in Figure 2A-1. The volumes recorded show two-way 24-hour vehicle volumes for an average weekday.

There are some difficulties in interpreting counts of this nature in detecting the separate components of short and long distance traffic. In particular, some interview stations were located near towns for operational reasons so that the proportion of local traffic was high. This accounts for the relatively high volumes recorded at stations R8 near Beni Suef, and R13 near Assuit. When vehicle trip tables were analyzed as part of developing the traffic forecasting model, the local and long distance components were separated out.

The other classified count stations where no interviewing was conducted were all located away from urban centers and give the best impression of the general volumes of traffic using the highway. As expected, the highest volumes of traffic were found at the northern end of the corridor, and the greatest concentration of traffic was on the main West Bank Cairo-Assuit Highway.

Comparison of Past Traffic Counts

Traffic count data was available from this Study for 1985, and from the Egypt National Transport Study (ENTS) (Reference 1) for both 1983 and 1979. Detailed comparisons are presented in Table 2A-2 between the 1983 and 1985 counts, and overall comparisons are made with 1979. All count sites were located close to Governorate boundaries and can be taken as reasonably comparable. The Beni Suef-Giza counts from this Study were extended to include the observed flows on the East Bank Highway, which were affected by the opening of the new bridge at Beni Suef in 1985. The counts of pickups and single trucks were combined since the definition of these two vehicle classifications were different between the two Studies.

Table 2A-1

AVERAGE 24-HOUR MANUAL CLASSIFIED TRAFFIC COUNTS
(Dec 85/Jan 86)

	STATION	CARS	TAXI-C	TAXI-V	PK-UP	TAXI-P	MICBUS	BUS	TRK-S	TRK-C	TRK-A	OTHER	ANIMAL	TOTAL	PCUS
Interview Stations															
R1	Giza-Fayoum	1,154	1,380	282	2,508	10	52	300	375	123	63	13	0	6,260	10,194
R2	Badrashin-Aiyat	1,344	3,000	604	2,639	35	167	679	2,671	592	189	84	41	12,046	23,799
R3	Tabin-Saff	838	750	574	918	42	64	604	1,120	203	124	11	9	5,257	10,708
R4	Tamiya-Gerza	28	47	19	470	0	0	13	160	12	3	69	10	830	1,869
R5	Gerza-Wasta	1,107	1,954	437	2,140	126	36	365	1,078	583	223	96	28	8,173	15,573
R6	Fayoum-Beni Suef	347	114	380	476	7	7	126	152	31	37	188	25	1,890	3,967
R7	Koraimat-Beni Suef	522	104	66	718	15	57	157	1,084	130	22	159	11	3,045	7,122
R8	Beni Suef-Biba	1,327	1,455	2,123	2,339	465	114	347	1,162	740	202	513	85	10,872	21,828
R9	Fashn-Edwa	579	1,328	175	1,495	10	16	216	822	556	238	30	4	5,468	10,885
R10	Matai-Samalut	809	1,072	488	2,177	377	35	256	779	625	269	91	26	7,005	14,015
R11	Minia-Abu Qurqas	967	834	837	1,663	260	24	194	1,028	407	157	136	12	6,519	12,771
R12	Deir Mawas-Dairut	567	908	183	1,370	42	28	162	1,061	500	161	50	11	5,043	10,567
R13	Manfalut-Assuit	1,969	2,020	2,100	2,065	277	298	361	1,699	552	165	316	54	11,877	22,332
R14	Assuit-Sahel	497	1,207	735	680	516	30	79	1,101	117	44	157	68	5,231	10,367
R15	Assuit-Abu Tig	1,337	2,246	1,392	1,474	354	292	159	1,104	290	135	283	180	9,246	17,665
R16	Assuit-Zarabi	664	1,617	549	722	243	50	48	445	20	16	183	84	4,641	8,074
Classified Count Stations (1)															
C1	Giza-West Desert Rd	2,349	2,167	927	3,423	14	325	482	984	331	102	48	5	11,156	18,721
C2	Giza-Sacara	2,159	597	903	1,778	24	205	175	1,178	149	93	211	98	7,571	14,410
C3	Giza-Badrashin	5,444	5,122	1,841	5,319	71	867	1,021	3,109	542	202	290	124	23,952	41,869
C4	Maadi-Helwan	13,376	6,298	4,062	5,837	267	885	2,328	2,427	925	780	244	64	37,494	60,070
C5	Wasta-Nasser (2)	1,176	2,284	1,093	2,578	265	32	400	1,611	719	314	206	39	10,717	21,000
C6	Biba-Fashn (2)	864	1,783	986	1,670	172	98	269	1,801	971	253	253	95	9,214	20,000
C7	Maghagha-Beni Mazaar	774	1,296	307	2,308	237	27	250	841	549	246	48	15	6,898	13,438
C8	Samalut-Minia	1,173	1,159	795	2,379	244	59	234	1,136	615	236	107	5	8,142	15,800
C9	Abu Qurqas-Mallawi	796	747	318	2,025	208	34	184	945	407	153	131	53	6,002	12,399
C10	Dairut-Quisiya	700	1,148	547	2,036	209	21	127	1,362	492	159	146	21	6,968	14,176
C11	Manfalut-Assuit	613	982	854	1,197	123	183	135	905	474	126	66	13	5,671	11,163

(1) Split between pick-up and taxi pick-up estimated from interview stations: R1 for C1, R2 for C2-3, and R9-12 for C5-11.
(2) Adjusted from Base Year Report after comparisons with other counts

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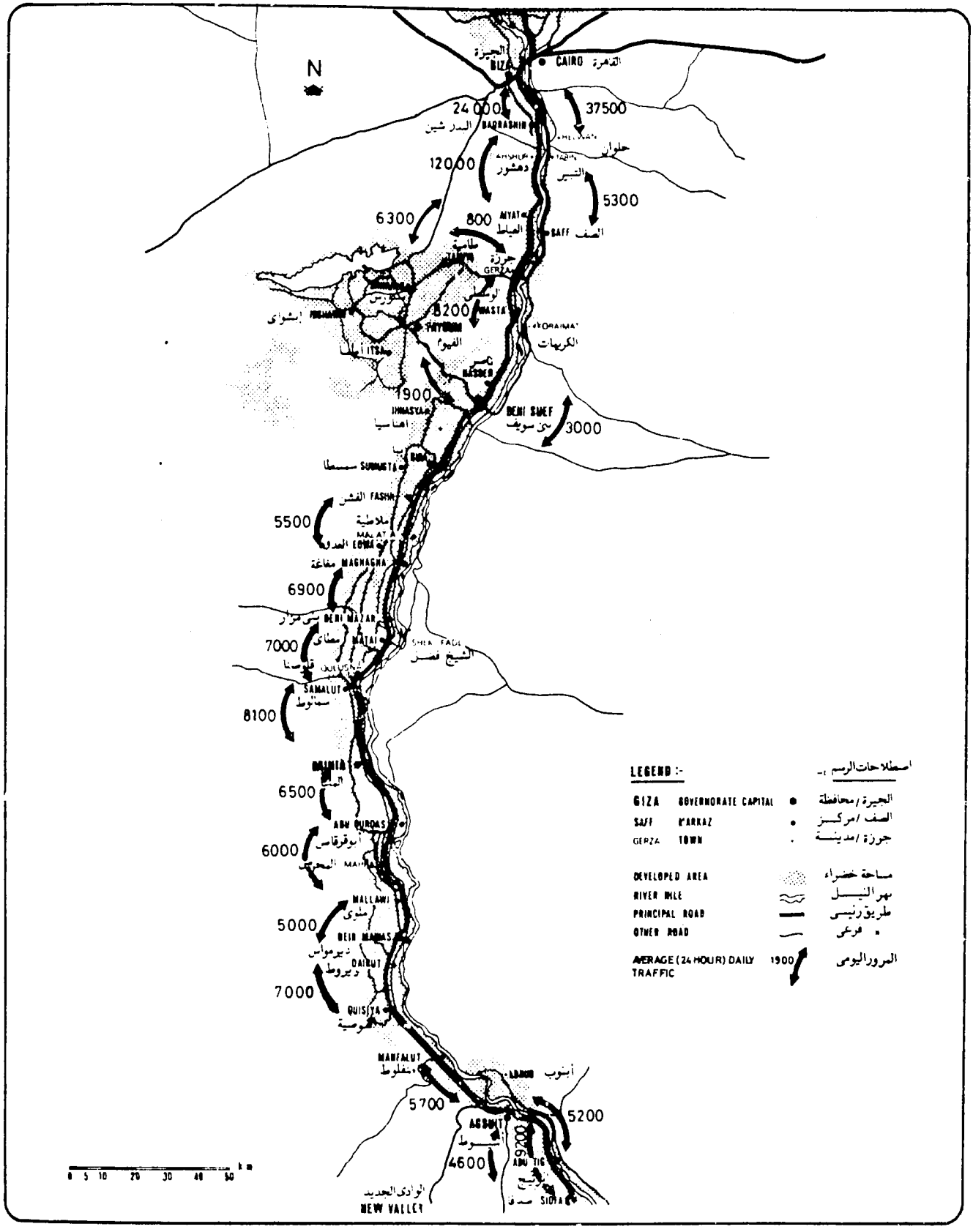

Cairo – Assuit Highway Feasibility Study

1986 ANNUAL AVERAGE DAILY TRAFFIC

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Figure 2A-1

Table 2A-2

TRAFFIC GROWTH RATES IN CORRIDOR: 1979-1985

GOVERNORATE BOUNDARY		CAR	TAXI	BUS	PICKUP/ SIN TRK	LARGE TRUCK	TOTAL	1979 ENTS TOTAL	ANNUAL GROWTH RATES 79-83	83-85	79-85
		(24 hour average daily traffic)									
Beni Suef-Giza (1)	CAS 85	1,243	2,456	176	3,708	959	8,542				
	ENTS 83	939	1,988	295	3,616	878	7,716	4,463	14.7%	4.7%	11.0%
Beni Suef-Minia (2)	CAS 85	579	1,503	232	2,327	794	5,435				
	ENTS 83	607	1,277	177	2,538	635	5,234	3,028	14.7%	1.7%	10.0%
Minia-Assuit (3)	CAS 85	567	1,091	190	2,473	661	4,982				
	ENTS 83	414	1,012	179	2,003	613	4,221	2,560	13.3%	7.8%	11.6%
Giza-Fayoum (4)	CAS 85	1,154	1,662	352	2,893	186	6,247				
	ENTS 83	930	1,474	180	1,209	165	3,958	2,772	9.3%	23.1%	14.0%
Fayoum-Beni Suef (5)	CAS 85	347	494	133	635	68	1,677				
	ENTS 83	222	432	64	680	63	1,461	1,222	4.6%	6.5%	7.3%
Total Traffic Estimates											
Total Fayoum Traffic	CAS 85	1,501	2,156	485	3,528	254	7,924				
	ENTS 83	1,152	1,906	244	1,889	228	5,419	1,405	40.1%	18.9%	32.8%
Annual Growth 83-85 (%)		12.8	5.8	36.7	32.8	5.0	18.9				
Total Main Highway	CAS 85	2,389	5,050	598	8,508	2,414	18,959				
	ENTS 83	1,960	4,277	651	8,157	2,126	17,171	8,018	21.0%	4.6%	15.1%
Annual Growth 83-85 (%)		9.4	7.8	-3.8	1.9	5.9	4.6				
Total Corridor	CAS 85	3,890	7,206	1,083	12,036	2,668	26,883				
	ENTS 83	3,112	6,183	895	10,046	2,354	22,590	9,423	24.4%	8.2%	18.7%
Annual Growth 83-85 (%)		10.7	7.2	9.1	8.6	5.9	8.2				

Sources: ENTS -- Egypt National Transport Study, Phase III, 1984
CAS -- Surveys conducted by this Study in the Cairo-Assuit Corridor

(1) ENTS Station 14, CAS Station R05+R07, Wasta and East Bank Desert Road
(2) ENTS Station 38, CAS Station R09, Malatea
(3) ENTS Station 39, CAS Station R12, Dairut
(4) ENTS Station 13, CAS Station R01, Fayoum Desert Road
(5) ENTS Station 72, CAS Station R06, Fayoum-Beni Suef Road

ENTS counts taken in October 1983 and Oct 1979
CAS counts taken mid-December 1985 to mid-January 1986
Estimated interval between counts is 2.2 years
% growth from '79 estimated to ENTS '83 count (Oct to Oct - 4 years)

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Traffic growth slowed between 1983 and 1985 compared with the very rapid increase of nearly 25 percent per year between 1979 and 1983. However, the traffic growth rate 1983-1985 at 8.2 percent per year was still higher than the growth in GDP in the same period (about 5.7 percent annual growth).

The roads to and from Fayoum showed the strongest growth, but this was entirely in the pickup and single truck class. A combined taxi and car class, and the heavy truck class, both showed stronger growth on the main Cairo-Assuit Highway.

There are two possible explanations for the more rapid growth in pickup and single truck traffic on the Fayoum road. One is the increasing role of Fayoum in supplying vegetables and fruit to Greater Cairo. A second explanation is that the period of the surveys of this Study coincided with the main tomato harvest in Fayoum, and this could have concentrated the available light vehicle fleet on the Fayoum Desert Road during this period.

It is unwise to put too much weight on the comparison of traffic counts from different studies, since accuracy, techniques and precise locations of stations can vary, and undetected discrepancies can lead to false conclusions. This is not to say that either the ENTS counts or the counts conducted by this Study are known to be in error. It is simply that there must be uncertainty in making comparison between the two Studies. A better situation would be to have a regular program of traffic counts conducted annually on the same basis, and which could be a data source for all agencies to refer to. It is believed that plans are advanced to start such a program. In the absence of this, comparison of independently made traffic counts can serve only as a guide to true growth rates.

Traffic Composition

The results presented previously in Table 2A-1 also show the composition of traffic passing the roadside interview and count sites.

Vehicles were classified into twelve categories, as follows (showing also the standard abbreviation used in these tables):

1. Private car (Car)
2. Standard taxi, normally a car (Taxi-C)
3. Service taxi, normally a van (Taxi-V)
4A. Goods pick-up and small vans (Pk-Up)
4B. Taxi pick-up (Taxi-P)
5. Microbus, normally with 17 to 26 seats (Micbus)
6. Standard bus, normally with 45 to 58 seats (Bus)
7. Single truck (Trk-S)
8. Combination truck, single truck towing a trailer (Trk-C)
9. Articulated truck, tractor towing a semi-trailer (Trk-A)
10. Other motorized, including tractors and motorcylces (Other)
11. Animals, or animal drawn vehicles (Animal)

The distribution of vehicles by class is illustrated for the main west bank highway in Figure 2A-2. The distribution in PCUs is also shown which is discussed later.

Pick-ups represented about 27 percent of the traffic stream. They appeared to have two quite separate roles; that of private utility vehicle practical for people who have a frequent need to transport small quantities of goods, and that of public taxi. For this reason, pick-ups were separated into two sub-groups to reflect these different roles. The sub-division was made on the basis of seating and passenger characteristics revealed in the Roadside Interview Survey. Pick-ups used as public taxis represented about 10 percent of total pick-ups.

Taxis, both cars and vans, represented a large proportion of the total traffic, outnumbering private cars. Bus volumes were surprisingly low; most were standard buses rather than the lower capacity microbus.

Trucks made up over 25 percent of the traffic. The majority were single trucks which outnumbered combination trucks 2:1. Articulated trucks accounted for only about 10 percent of total trucks.

Traffic Composition by Location - The distribution of vehicle types varied considerably by location. Table 2A-3 summarizes the distributions for various parts of the survey area.

The proportion of private cars was much higher than average at the count stations closest to Cairo, not surprisingly since these counts intercepted significant quantities of Greater Cairo commuter traffic.

The three routes linking Fayoum with the corridor were very low on truck traffic, but were much higher for pick-ups. This indicates that the pick-up was used for the generally shorter distance freight traffic.

The East Bank Highway had a high proportion of trucks, possibly reflecting use of this route to Beni Suef by heavy traffic from the industrial area of Helwan. The high proportion of buses on the East Bank road was linked to the large number of factory buses which transport workers to and from the steel mills of Helwan.

South of Assuit, the proportion of trucks went down, but the total number of trucks did not appear to be greatly diminished comparing station R13 north of Assuit with the sum of stations R14 to R16 on the south side.

Hourly Traffic Variation

The variation in traffic by hour of day is shown in Table 2A-4, which represents an average of the traffic counted at the three 24-hour interview stations on the west bank highway. Totals do not agree exactly with those tabulated in the appendices which use a more sophisticated factoring and adjustment process. However, the data in Table 2A-4 is sufficient to portray hourly movement patterns. Traffic volumes by vehicle class are shown by hour of day, and are then summarized for the three main periods of interest, all measured from 6:00am.

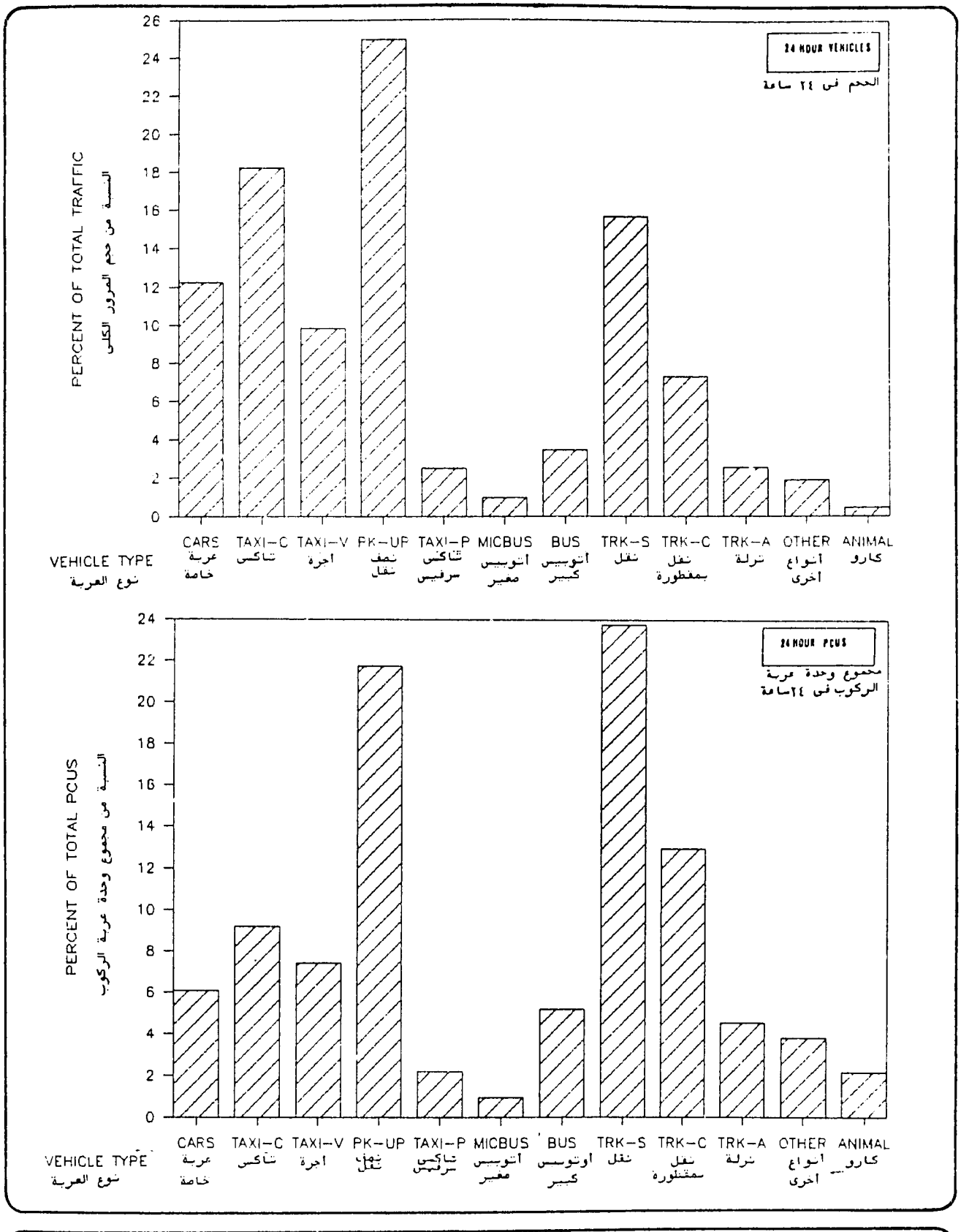
Table 2A-3

SUMMARY OF TRAFFIC COUNTS BY LOCATION
(Dec 85/Jan 86)

STATION	CARS	TAXI-C	TAXI-V	PK-UP	TAXI-P	MICRUS	BUS	TRK-S	TRK-C	TRK-A	OTHER	ANIMAL	TOTAL
Summary by Vehicles													
Fayoum	1,529	1,541	681	3,454	17	59	439	687	166	103	269	35	8,980
East Bank	1,360	854	640	1,636	57	122	761	2,204	333	146	170	20	8,302
Near Cairo	23,328	14,185	7,734	16,357	375	2,283	4,006	7,698	1,947	1,178	792	291	80,173
South of Assuit	2,498	5,070	2,676	2,876	1,113	372	286	2,650	427	195	623	332	19,118
Main Corridor	14,765	21,971	11,847	30,082	3,051	1,173	4,179	18,901	8,781	3,090	2,271	504	120,615
GRAND TOTAL	43,480	43,621	23,577	54,405	4,612	4,008	9,671	32,140	11,654	4,717	4,126	1,182	237,189
Percent Vehicles													
Fayoum	17.0%	17.2%	7.6%	38.5%	0.2%	0.7%	4.9%	7.7%	1.8%	1.1%	3.0%	0.4%	100.0%
East Bank	16.4%	10.3%	7.7%	19.7%	0.7%	1.5%	9.2%	26.5%	4.0%	1.8%	2.0%	0.2%	100.0%
Near Cairo	29.1%	17.7%	9.6%	20.4%	0.5%	2.8%	5.0%	9.6%	2.4%	1.5%	1.0%	0.4%	100.0%
South of Assuit	13.1%	26.5%	14.0%	15.0%	5.8%	1.9%	1.5%	13.9%	2.2%	1.0%	3.3%	1.7%	100.0%
Main Corridor	12.2%	18.2%	9.8%	24.9%	2.5%	1.0%	3.5%	15.7%	7.3%	2.6%	1.9%	0.4%	100.0%
GRAND TOTAL	18.3%	18.4%	9.9%	22.9%	1.9%	1.7%	4.1%	13.6%	4.9%	2.0%	1.7%	0.5%	100.0%
Summary by PCUs													
PCU Value by vehicle type	1	1	1.5	1.75	1.75	2	3	3	3.5	3.5	4	10	
Fayoum	1,529	1,541	1,022	6,045	30	117	1,317	2,061	581	361	1,077	350	16,030
East Bank	1,360	854	960	2,863	100	243	2,283	6,612	1,166	511	680	199	17,830
Near Cairo	23,328	14,185	11,600	28,625	656	4,565	12,017	23,093	6,815	4,123	3,170	2,914	135,090
South of Assuit	2,498	5,070	4,014	5,033	1,948	744	858	7,950	1,495	683	2,492	3,323	36,106
Main Corridor	14,765	21,971	17,770	52,643	5,338	2,346	12,538	56,704	30,735	10,815	9,086	5,037	239,747
GRAND TOTAL	43,480	43,621	35,366	95,208	8,072	8,016	29,012	96,420	40,791	16,492	16,504	11,822	444,804
Percent PCUs													AVERAGE PCU FACTOR
Fayoum	9.5%	9.6%	6.4%	37.7%	0.2%	0.7%	8.2%	12.9%	3.6%	2.2%	6.7%	2.2%	1.8
East Bank	7.6%	4.8%	5.4%	16.1%	0.6%	1.4%	12.8%	37.1%	6.5%	2.9%	3.8%	1.1%	2.1
Near Cairo	17.3%	10.5%	8.6%	21.2%	0.5%	3.4%	8.9%	17.1%	5.0%	3.1%	2.3%	2.2%	1.7
South of Assuit	6.9%	14.0%	11.1%	13.9%	5.4%	2.1%	2.4%	22.0%	4.1%	1.9%	6.9%	9.2%	1.9
Main Corridor	6.2%	9.2%	7.4%	22.0%	2.2%	1.0%	5.2%	23.7%	12.8%	4.5%	3.8%	2.1%	2.0
GRAND TOTAL	9.8%	9.8%	8.0%	21.4%	1.8%	1.8%	6.5%	21.7%	9.2%	3.7%	3.7%	2.7%	1.9

Summaries based on the following stations (see Table 3-1):

Fayoum	R1, R4, R6
East Bank	R3, R7
Near Cairo	C1-C4
South of Assuit	R14-R16
Main Corridor	R2, R5, R8-R13, C5-C11



Cairo – Ascult Highway Feasibility Study

TRAFFIC DISTRIBUTION BY VEHICLE CLASS

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Figure 2A-2

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Table 2A-4

HOURLY VARIATION IN TRAFFIC VOLUMES
(Average of 24 hour stations on west bank highway: R5, R9 and R12)

HR END	CARS	TAXI-C	TAXI-V	PK-UP	MICRUS	BUS	TRK-S	TRK-C	TRK-A	OTHER	ANIMAL	TOTAL	PCUS
1	39	98	12	165	2	12	129	71	15	0	0	543	1172
2	21	91	9	141	2	12	107	58	11	0	0	452	975
3	16	89	7	124	2	12	92	55	10	0	0	407	876
4	14	65	12	94	4	6	62	47	11	2	0	317	605
5	9	52	10	78	0	2	56	42	13	0	0	262	579
6	12	61	13	63	1	8	59	30	7	0	0	254	535
7	30	65	20	104	2	12	85	33	11	4	2	368	792
8	56	118	34	165	1	35	131	65	23	6	1	635	1356
9	97	176	56	222	4	53	157	67	25	13	1	871	1768
10	144	217	52	260	9	53	150	80	30	17	6	1018	2034
11	159	240	46	270	2	67	146	77	34	15	5	1061	2082
12	165	263	60	275	5	54	151	82	32	18	6	1111	2155
13	148	269	59	269	4	55	134	77	24	16	3	1058	1999
14	160	255	42	256	0	50	143	64	33	16	3	1022	1939
15	172	267	53	295	4	58	137	75	33	17	4	1115	2114
16	224	309	62	323	2	60	153	78	35	19	3	1268	2336
17	205	284	77	309	14	44	157	92	32	17	3	1234	2308
18	168	242	46	339	3	47	129	71	30	14	1	1090	2026
19	128	233	42	288	4	41	129	70	17	4	0	956	1767
20	105	187	38	254	3	21	120	83	18	2	0	831	1584
21	82	146	24	221	1	14	125	65	22	4	0	704	1390
22	69	148	27	206	2	14	112	57	17	1	0	653	1263
23	54	133	23	192	9	13	113	57	20	1	1	616	1237
24	50	122	14	167	2	14	108	59	17	1	0	554	1175
1	1.7%	2.4%	1.4%	3.2%	2.4%	1.6%	4.5%	4.6%	2.9%	0.0%	0.0%	3.0%	3.2%
2	0.9%	2.2%	1.1%	2.8%	2.4%	1.6%	3.7%	3.7%	2.1%	0.0%	0.0%	2.5%	2.7%
3	0.7%	2.2%	0.8%	2.4%	2.4%	1.6%	3.2%	3.5%	1.9%	0.0%	0.0%	2.2%	2.4%
4	0.6%	1.6%	1.4%	1.9%	4.9%	0.8%	2.1%	3.0%	2.1%	1.1%	0.0%	1.7%	1.9%
5	0.4%	1.3%	1.2%	1.5%	0.0%	0.3%	1.9%	2.7%	2.5%	0.0%	0.0%	1.4%	1.6%
6	0.5%	1.5%	1.6%	1.2%	1.2%	1.1%	2.0%	1.9%	1.3%	0.0%	0.0%	1.4%	1.5%
7	1.3%	1.6%	2.4%	2.0%	2.4%	1.6%	2.9%	2.1%	2.1%	2.1%	5.1%	2.0%	2.2%
8	2.4%	2.9%	4.1%	3.2%	1.2%	4.6%	4.5%	4.2%	4.4%	3.2%	2.6%	3.5%	3.8%
9	4.2%	4.3%	6.7%	4.4%	4.9%	7.0%	5.4%	4.3%	4.8%	7.0%	2.6%	4.7%	4.9%
10	6.2%	5.3%	6.2%	5.1%	11.0%	7.0%	5.2%	5.1%	5.8%	9.1%	15.4%	5.5%	5.6%
11	6.8%	5.8%	5.5%	5.3%	2.4%	8.9%	5.1%	5.0%	6.5%	8.0%	12.8%	5.8%	5.8%
12	7.1%	6.4%	7.2%	5.4%	6.1%	7.1%	5.2%	5.3%	6.2%	9.6%	15.4%	6.0%	6.0%
13	6.4%	6.5%	7.0%	5.3%	4.9%	7.3%	4.6%	5.0%	4.6%	8.6%	7.7%	5.8%	5.5%
14	6.9%	6.2%	5.0%	5.0%	0.0%	6.6%	5.0%	4.1%	6.3%	8.6%	7.7%	5.6%	5.4%
15	7.4%	6.5%	6.3%	5.8%	4.9%	7.7%	4.7%	4.8%	6.3%	9.1%	10.3%	6.1%	5.9%
16	9.6%	7.5%	7.4%	6.4%	2.4%	7.9%	5.3%	5.0%	6.7%	10.2%	7.7%	6.9%	6.5%
17	8.8%	6.9%	9.2%	6.1%	17.1%	5.8%	5.4%	5.9%	6.2%	9.1%	7.7%	6.7%	6.4%
18	7.2%	5.9%	5.5%	6.7%	3.7%	6.2%	4.5%	4.6%	5.8%	7.5%	2.6%	5.9%	5.6%
19	5.5%	5.6%	5.0%	5.7%	4.9%	5.4%	4.5%	4.5%	3.3%	2.1%	0.0%	5.2%	4.9%
20	4.5%	4.5%	4.5%	5.0%	3.7%	2.8%	4.2%	5.3%	3.5%	1.1%	0.0%	4.3%	4.4%
21	3.5%	3.5%	2.9%	4.4%	1.2%	1.8%	4.3%	4.2%	4.2%	2.1%	0.0%	3.8%	3.9%
22	3.0%	3.6%	3.2%	4.1%	2.4%	1.8%	3.9%	3.7%	3.3%	0.5%	0.0%	3.5%	3.5%
23	2.3%	3.2%	2.7%	3.8%	11.0%	1.7%	3.9%	3.7%	3.8%	0.5%	2.6%	3.3%	3.4%
24	2.1%	3.0%	1.7%	3.3%	2.4%	1.8%	3.7%	3.8%	3.3%	0.5%	0.0%	3.0%	3.1%
11 hrs (6am-5pm)	1560	2463	561	2748	47	541	1544	790	312	158	37	10761	20082
16 hrs (6am-10pm)	2112	3419	738	4056	60	678	2159	1136	416	183	38	14995	28911
24 hours	2327	4130	838	5080	82	757	2885	1555	520	187	39	18400	36095
Factor 11/16 hrs	74%	72%	76%	68%	78%	80%	72%	70%	75%	86%	97%	72%	72%
11/24 hrs	67%	60%	67%	54%	57%	71%	54%	51%	60%	84%	95%	59%	58%
16/24 hrs	91%	83%	88%	80%	73%	90%	75%	73%	80%	98%	97%	81%	80%

13

The 11-hour period from 6:00am to 5:00pm represented the period of daylight in Upper Egypt at the time of the survey. Traffic questionnaires were completed over these hours only at most of the interview stations. On average, some 60 percent of passenger vehicles moved during this period, but only just over half of the trucks.

The 16-hour period from 6:00am to 10:00pm represents the traditional period for which traffic counts are normally maintained in traffic studies, and covers most of the traffic movements of the day. However, 15 percent of passenger vehicles and 25 percent of trucks moved in the overnight period from 10:00pm to 6:00am.

The results are summarized in Figure 2A-3, showing the variation separately for passenger vehicles, pick-ups and trucks. The higher percentage of night time truck movements shows up clearly. For all vehicles, but particularly passenger vehicles, there were two peaks during the day. One occured at 11:00am and the other between 3:00pm and 4:00pm. This reflects a gradual build up in activity through the main part of the day, with a rest period in the middle of the day when drivers stopped for lunch. The busiest time of day appears to be from 3:00pm to 4:00pm.

Daily Traffic Variation

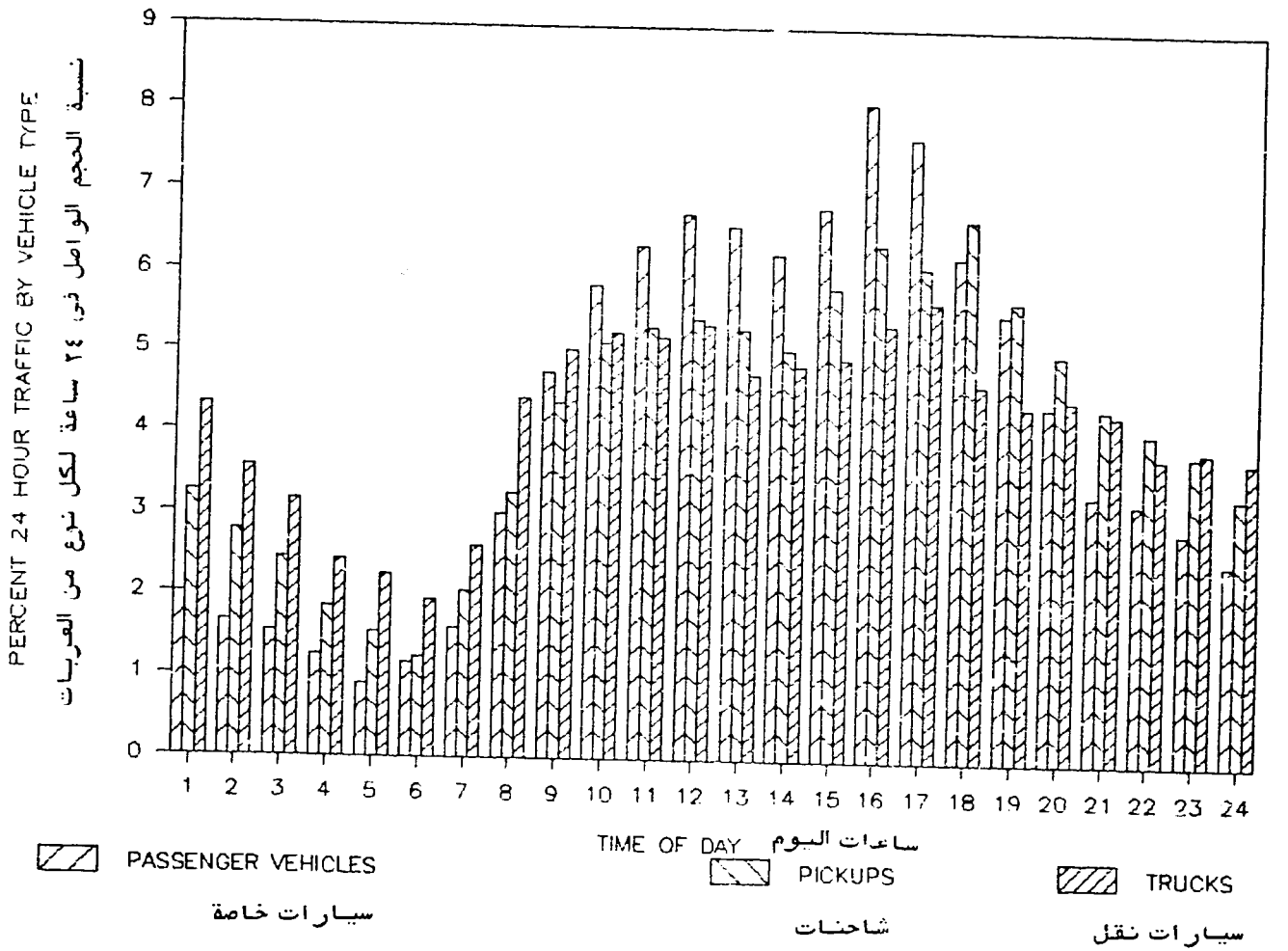
There was significant variation in traffic volumes between days of the week and these are illustrated in Figure 2A-4, separately for passenger vehicles, pick-ups and trucks.

For many days, the pattern was similar for all classes of vehicles. In particular, Tuesday was low and Monday was high compared to the average. However, trucks tended to be particularly low on Friday and even Saturday, perhaps reflecting less activity over the weekend, while passenger travel remained at the average reflecting substitution of business trips by leisure travel. Thursday was a high day for both vehicle classes, which is a common phenomenon in other countries for the day before the weekend.

Passenger Car Equivalents

Measurements of road capacity and traffic congestion require an assessment of the relative occupancy of road space by different vehicle types. This is usually done by attaching an "equivalent passenger car unit" (PCU) value to each vehicle which measures the size of the vehicle relative to a normal passenger car. Estimates of traffic in terms of PCUs were presented in Table 2A-1, Table 2A-3 and Figure 2A-2.

A study of PCU values appropriate to rural roads in Egypt was completed in 1984 (Determination of PCE Factors for the Egyptian Rural Road Network (Reference 11). This work was based on measurements on the Alexandria Agricultural Road, with traffic conditions approximating to level of service D. Results appear to be consistent over three observation points. The following results were obtained:



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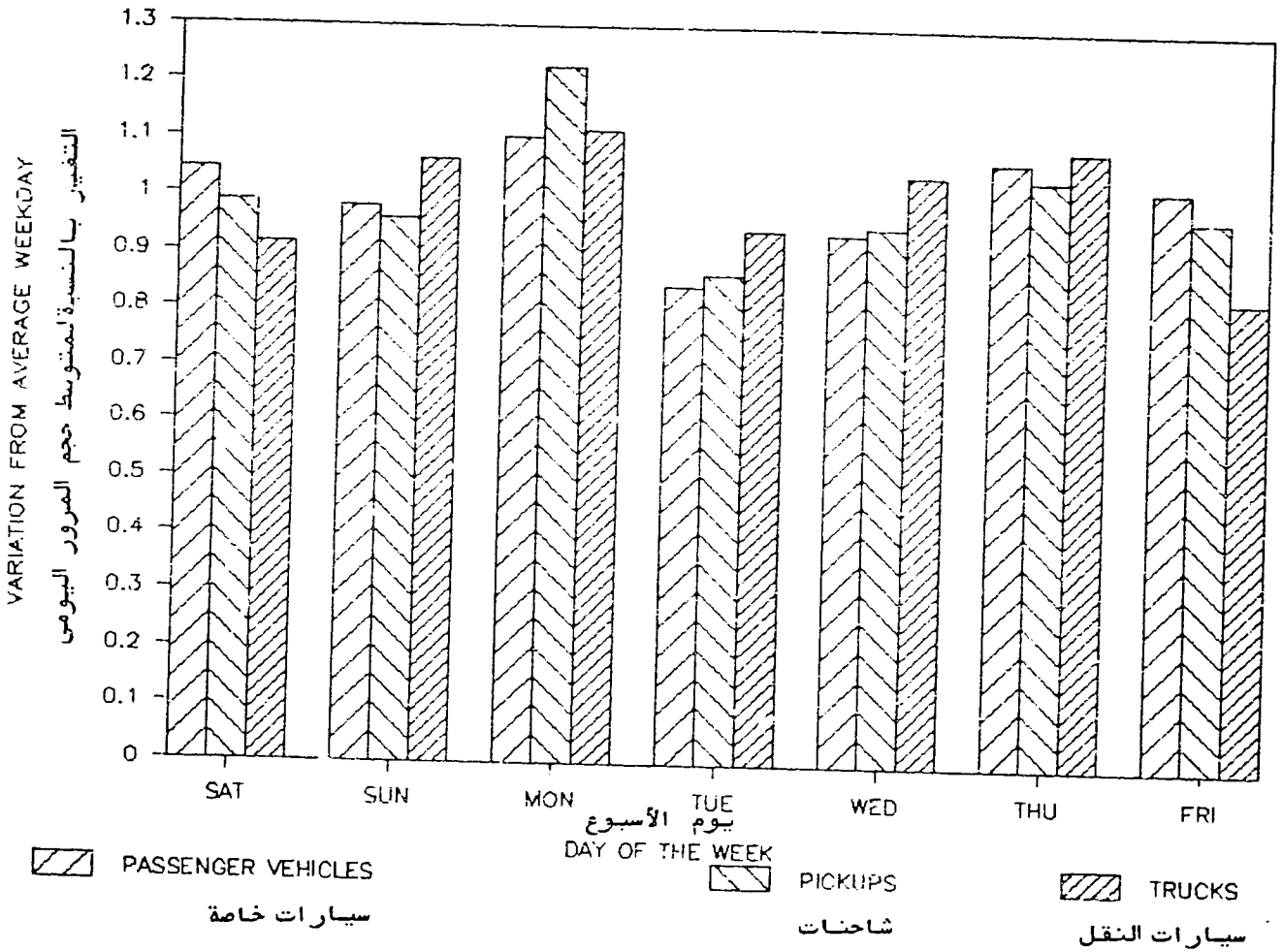
TRAFFIC DISTRIBUTION BY TIME OF DAY

Figure 2A-3



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TRAFFIC DISTRIBUTION BY DAY OF WEEK

Figure 2A-4

Passenger car	1.0
Pick-up	1.76
Microbus	2.13
Trucks, buses	2.93
Truck trailer	3.53

The factor of 2.93 for normal trucks and buses compares well with the commonly accepted value of 3.0. The higher 3.53 factor for the particularly large truck-trailer combinations seems reasonable, as does the smaller factor for microbuses.

Phase II of ENTS defined rather high PCU values for truck-trailer combinations and for buses (4.7 and 6.3 respectively). These seem out of line with the measurements discussed above and with normally accepted practice. However, ENTS did make some useful estimates of PCU values for animal carts and for other slow traffic (essentially the non-motorized group in this Study). The relevant values are:

Animal cart	21.8
Tractors	14.6
Motor cycles	1.8

PCU Values for this Study - PCU values for this Study were based mainly on the study of the Alexandria Desert Road discussed above. Values for animal drawn and other motorized vehicles were adopted from ENTS Phase II, after adjusting down the generally higher than usual PCU values estimated by ENTS, and allowing for the mix of vehicles in the Other Motorized class.

On the basis of the these PCU studies, the following PCU factors were adopted for this Study:

Private car	1.0
Taxi car	1.0
Taxi van	1.5
Pick-up	1.75
Microbus	2.0
Standard bus	3.0
Single truck	3.0
Comb truck	3.5
Artic truck	3.5
Other	4.0
Animal drawn	10.0

Comments on PCU Estimates - The overall PCU factor, that is to say, the ratio of the estimates of total PCUs to total vehicles, averaged 2.0 in the main corridor, with higher values measured on the east bank and lower values elsewhere. These values reflect the very high content of heavy vehicles in the traffic stream.

Table 2A-3 and Figure 2A-2 indicate that heavy vehicles (trucks and buses) made up just under 30 percent of the traffic stream in the main corridor, when measured in numbers of vehicles, but over 46 percent when

measured in PCUs. Slower vehicles (Other Motorized and Animal) represented only 2.3 percent of vehicles in the main corridor, but 6.0 percent of PCUs, reflecting the traffic congesting nature of this type of traffic.

Traffic Speeds

Initial estimates of traffic speeds were derived from the Traffic Speed Survey reported in Appendix 1E.

Measurements were made for light vehicles (cars, taxis and pick-ups) and for heavy vehicles (buses and trucks) over a total of 222 links which the corridor was divided into. Each link was classified according to the type of development (urban, heavy village, light village and open), and also by nature of road construction (4-lane, 2-lane with shoulder and 2-lane without shoulder). Speed measurements were classified by these categories and are reported in Table 2A-5.

The table generally shows that higher speeds were associated with lighter vehicles, less development and wider road construction. This is as expected. There are some apparent discrepancies; for example, the 2-lane road with shoulder speeds are not always higher than the 2-lane road without shoulders for the same category of development. These effects can be explained partly by traffic volume differences (and therefore traffic congestion differences) and in some instances by some categories being represented by few measurements, and thus being less reliable.

On average, traffic speed between Cairo and Assuit were measured at 55 and 61 kilometers per hour for heavy and light vehicles respectively. The relative closeness in the two measurements reflects the almost complete absence of grades and curves along the route which would slow down trucks. The relatively slow speed for both vehicle classes reflects the congestion in the numerous towns and villages along the route. It can be noted that only half the route passes through open country.

Table 2A-5

MEASURED JOURNEY SPEEDS

ROAD CATEGORY	DEVELOPMENT CATEGORY	DISTANCE (kms)	AVERAGE SPEEDS Light (kms per hour)	AVERAGE SPEEDS Heavy (kms per hour)
4-lane	Urban	13	47	41
	Heavy Village	16	60	57
	Light Village	32	68	58
2-lane with shoulder	Heavy Village	18	39	39
	Light Village	12	65	57
	Open country	37	70	60
2-lane, no shoulder	Urban	1	20	16
	Heavy village	13	53	49
	Light village	73	63	56
	Open country	150	65	59
	TOTAL/AVERAGE	365	61	55

Appendix 2B

1986 HIGHWAY TRAFFIC CHARACTERISTICS

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Appendix 2B

1986 HIGHWAY TRAFFIC CHARACTERISTICS

This Appendix reviews the characteristics of vehicles as revealed in the two main surveys carried out by the Study: the Roadside Interview Survey and the Truck Weighing Survey. The two surveys are treated jointly since they were designed to be compatible and the complete description of truck characteristics requires the combination of the two sets of data.

Summary tabulations of each survey are provided in Appendix 1G (Roadside Interview Survey Tabulations) and 1F (Truck Weighing Survey Tabulations). A full set of tabulations has been prepared, but these run to several hundred pages since each survey station is tabulated separately.

Although animal drawn vehicles were counted in the surveys, the drivers (owners) were not interviewed since it was assumed that such traffic could not be long distance. Therefore, no tabulations were prepared on animal drawn traffic and they are excluded from the subsequent discussion.

Although the data presented in this Appendix appear to be similar to those presented in Chapter 4 of the Base Year Transport Report, all data have been modified to eliminate double counting of vehicles at several interview stations.

In the following discussion, unless otherwise indicated, values referred to are averages of all vehicles surveyed. To simplify the text, the word "average" has been omitted in most cases.

Passenger Vehicle Characteristics

All vehicles are capable of carrying passengers so this discussion includes all the vehicle classes surveyed.

Seating and Occupancy - Figure 2B-1 shows both the number of seats per vehicle and vehicle occupancy for each vehicle class. Not surprisingly, the two bus classes had most seats and the highest occupancy (in numbers of passengers carried). Buses at 47 seats had nearly twice the capacity of microbuses at 25 seats; average occupancy for the two vehicle types was 36 and 21 respectively (including the driver).

Taxi vans and taxi pick-ups were of similar characteristics with a capacity and occupancy of about 11-12 and 10 respectively. Most of the inter-city taxi cars were Peugeot 504 station wagons with about 7 seats and high occupancy of 6 persons. Cars had less seats (5) and ran about half full.

Trucks and pick-ups had between 2 and 3 seats, and averaged an occupancy of about 2 persons.

Vehicles with No Passengers - Figure 2B-2 shows the percentage of vehicles in each class with just a driver and no passengers.

The class of Other Motorized, consisting of tractors and motorcycles, ran 55 percent empty, but this was an exception. Only 15 to 20 percent of trucks were without passengers. In many cases for long distance trucks, the passenger would have been a reserve driver or loading assistant. The public transport vehicles - buses and taxis - ran only 4 to 8 percent empty, but 28 percent of cars carried no passengers.

Passenger Distribution and Purpose - These characteristics are shown in Figure 2B-3. Purpose of journey was only asked for cars and taxis and a few of these vehicles gave no answer to the question on purpose.

Over 75 percent of taxis of all classes gave work or business as the journey purpose. The remainder of the taxis mostly quotod "Other" meaning personal business such as shopping. About 7 percent of taxi cars were used for holiday or touring, but only 3 to 5 percent of the other taxis were used for this purpose.

Private cars were used only 55 percent for work or business. Nearly 20 percent were involved in holiday or touring and 25 percent were used for other purposes.

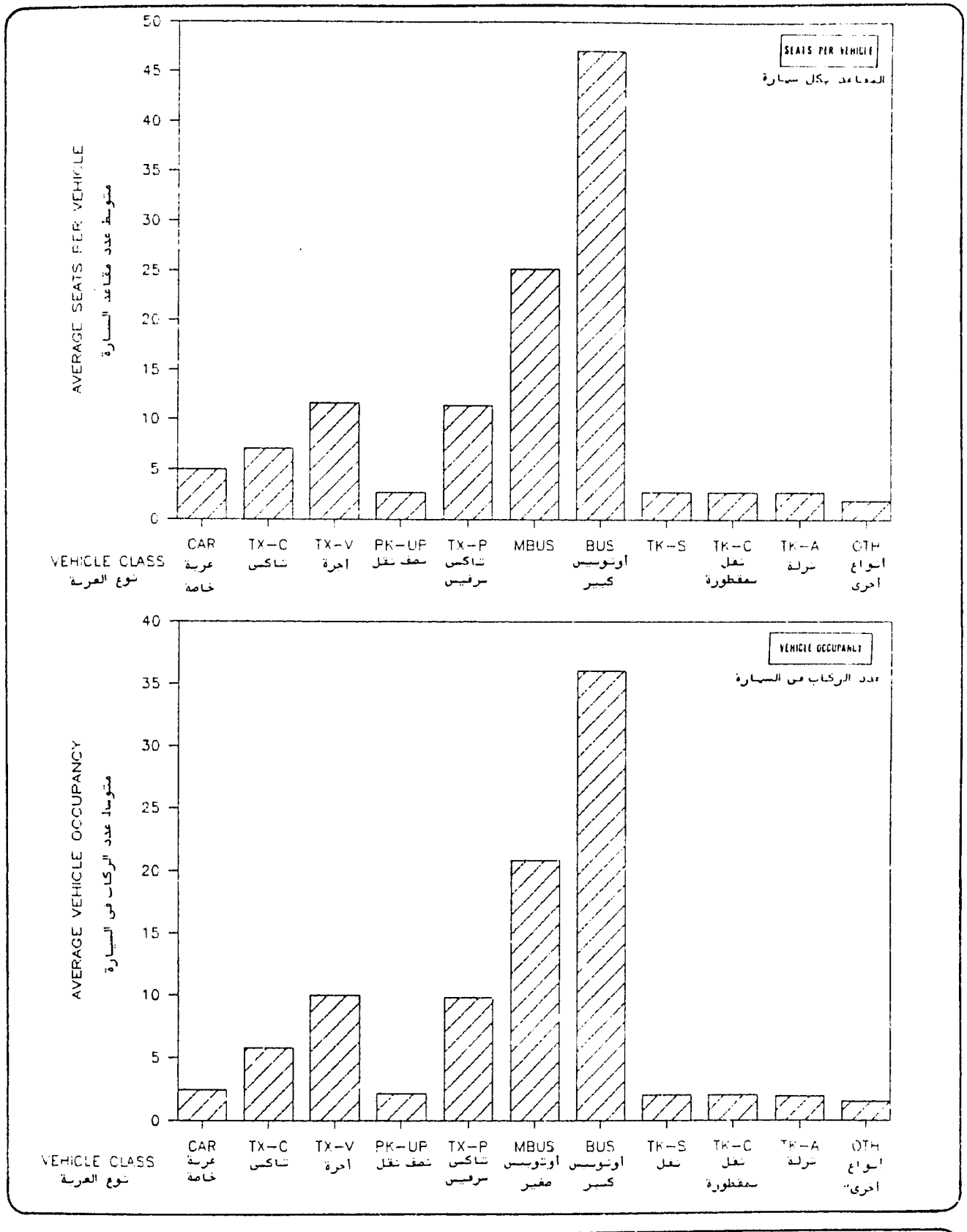
The distribution of passengers (including drivers) among the vehicle classes show that taxis as a class (cars, vans and pick-ups) accomodated nearly half the total passengers (49 percent), with most in taxi cars and taxi vans (19 and 24 percent respectively). The two classes of buses between them carried 29 percent of all passengers, with most (23 percent of all passengers) in the standard bus. Private cars accounted for only 6-7 percent of persons carried.

Truck Characteristics

This discussion includes the three main classes of truck: single trucks with no trailer, combination trucks (single trucks pulling a draw-bar trailer which has axles at the front and rear), and articulated trucks (tractor units pulling a semi-trailer with axles only at the rear). Pick-ups are not included.

Licensed Truck Weights - Trucks are normally measured in terms of either their empty weight, their carrying capacity or their fully loaded weight.

The empty weight is determined by the characteristics of the manufactured truck, either as purchased or as subsequently modified. These characteristics also determine the potential load carrying capacity of the truck: this capacity can be exceeded only at risk of damage to the truck. The sum of the empty weight and the carrying capacity give the fully loaded weight of the truck.



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VEHICLE PASSENGER CHARACTERISTICS

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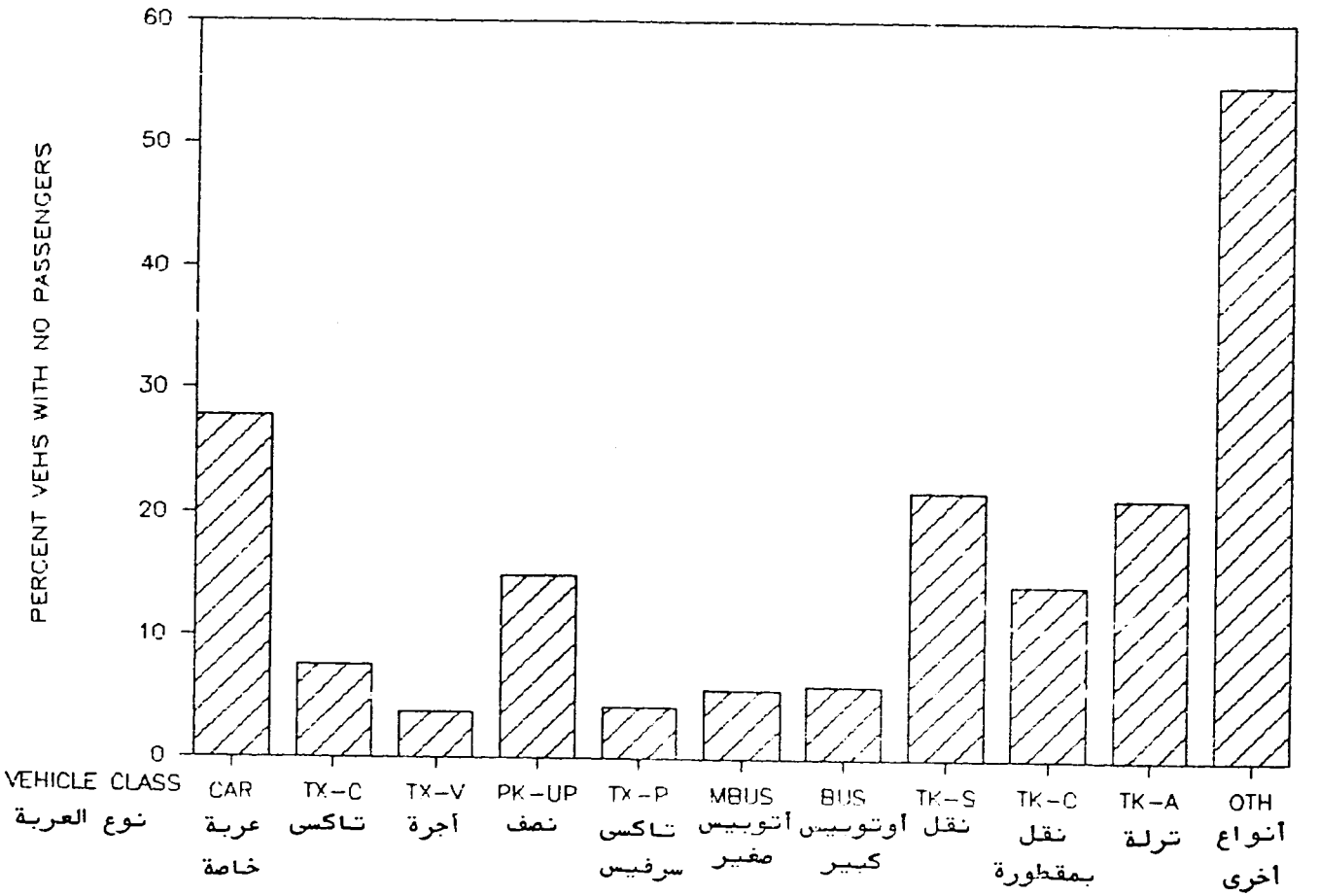
Figure 2B - 1



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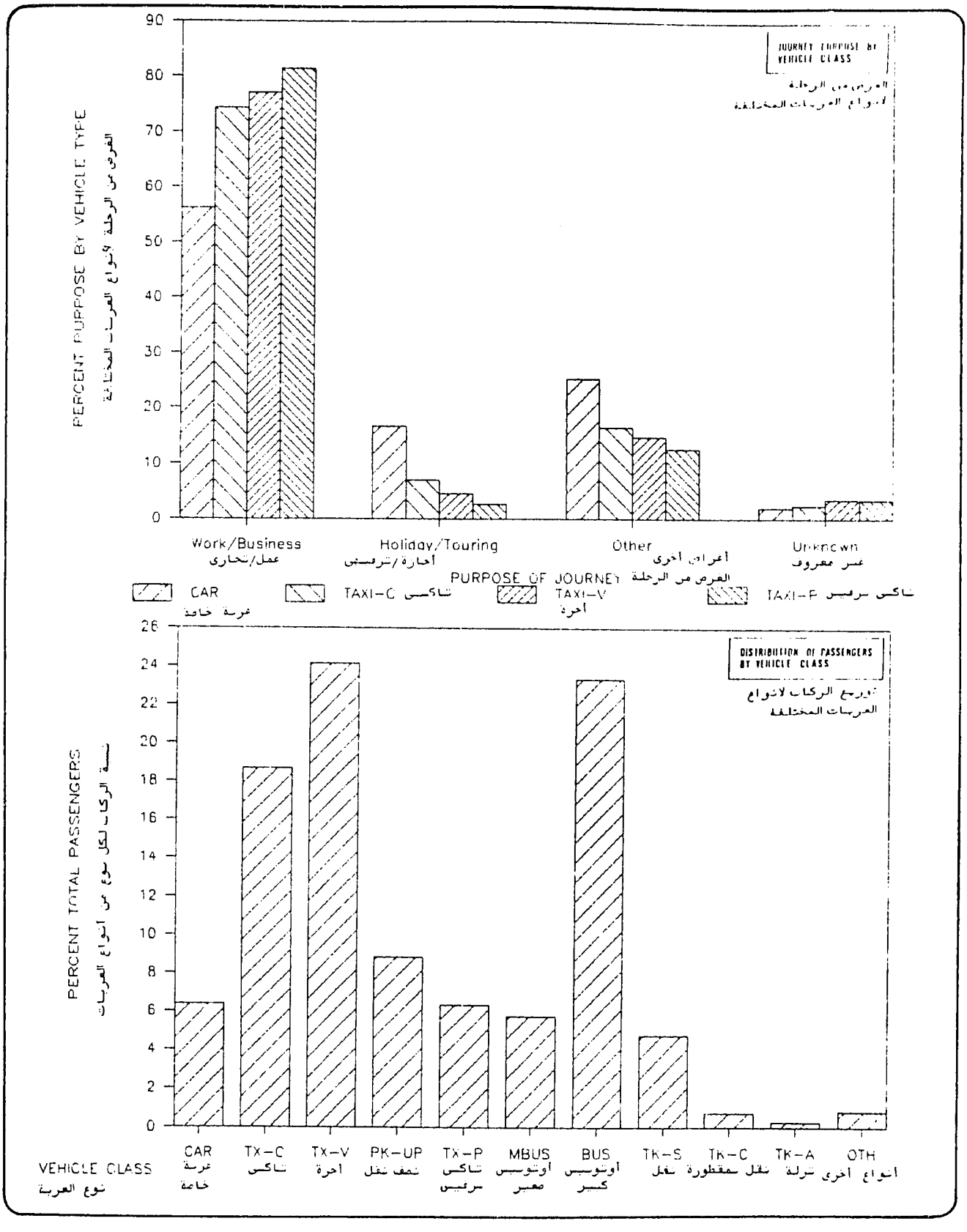
VEHICLES WITH NO PASSENGERS

Figure 2B – 2



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PASSENGERS BY PURPOSE AND VEHICLE TYPE

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Figure 2B-3

Truck weights are normally licensed by a Central Authority, and this is the case in Egypt. For licensing purposes, after allowing for the actual vehicle dimensions and capacities as manufactured, an additional very important consideration is the law regarding maximum legal loads which are permitted on axles. These laws are necessary since overloaded axles can cause a disproportionate amount of damage to the highway resulting in high costs of maintenance and repair for the highway authorities.

Legal axle loads in Egypt are as follows:

Single axle	- 10 tons
Tandem axle (two axles closely spaced)	- 16 tons
Tridem axle (three axles closely spaced)	- 22 tons
Quadram axle (four axles closely spaced)	- 30 tons

The legal axle loads and total vehicle weights for a variety of trucks is shown in Figure 2B-4. It can be seen that the maximum fully loaded weight of any truck is 52 tons, and this is for the very rare 7-axle truck, of which less than five were observed in the entire survey period (and these were all combination trucks with two tandem axles on the towing vehicle - a type of vehicle not normally permitted in Egypt). Hence the maximum licensed weight of any truck normally on the road should be no more than 48 tons which applies to the biggest 6-axle combination trucks.

However, it appears that many trucks are licensed to carry loads which put them considerably in excess of the maximum legal loads. Recorded licensed weights for the 6-axle combination trucks are shown in Figure 2B-5; it appears that some 60 percent of these trucks were licensed to carry more than the axle load law specifies.

The causes of this discrepancy appear to be various. First, many trucks are imported into Egypt which are capable of carrying much heavier loads than the Egyptian law permits. For example, many European countries permit axle loads of 13 and 20 tons on single and tandem axles respectively. Until two years ago, such vehicles were permitted to be imported on payment of a fine, and then they were licensed for their design axle loads, and not the legal axle loads applying in Egypt.

The rationale for this was probably that the necessarily high empty weight of trucks built strong enough to carry high axle loads, when combined with low axle weights permitted by law, would otherwise result in a very low payload for what must be an expensive truck.

Secondly, the licensing authorities routinely license trucks to exceed normal loads by 5 tons or 10 percent as a concession to truckers who work within a tight tariff structure and who wish to maximize their payload.

The combination of these two reasons accounts for the very high licensed loaded truck weights observed in the survey.

Truck Size and Configuration - Because of the somewhat arbitary nature of the licensing of loaded truck weights, the distribution of surveyed trucks by size is shown, also in Figure 2B-5, in terms of the empty weight. The great majority of single trucks were in the 5-6 ton empty weight category. About 10 percent of combination and articulated trucks were less than 10 tons empty, and the majority were between 13 and 16 tons.

In Figure 2B-6, the distribution of trucks by the number of axles is shown (counting two axles for a tandem and three axles for a tridem). The great majority of single trucks had just two axles, with only 3.5 percent with a tandem rear axle. A tiny proportion (0.2 percent) of single trucks had tandem axles front and rear. About 62-64 percent of combination and articulated trucks were 4-axle with most of the remainder with five axles. Only a very few 3-axle articulateds were observed, and an even smaller number of 7-axle combination trucks.

Figure 2B-7 shows the observed truck and trailer configurations of combination and articulated trucks. For most combination trucks, the towing vehicle had two single axles with only 14 percent having a tandem rear axle. Tandem rear axles on the trailer were more common, with about 40 percent of combination trucks so configured.

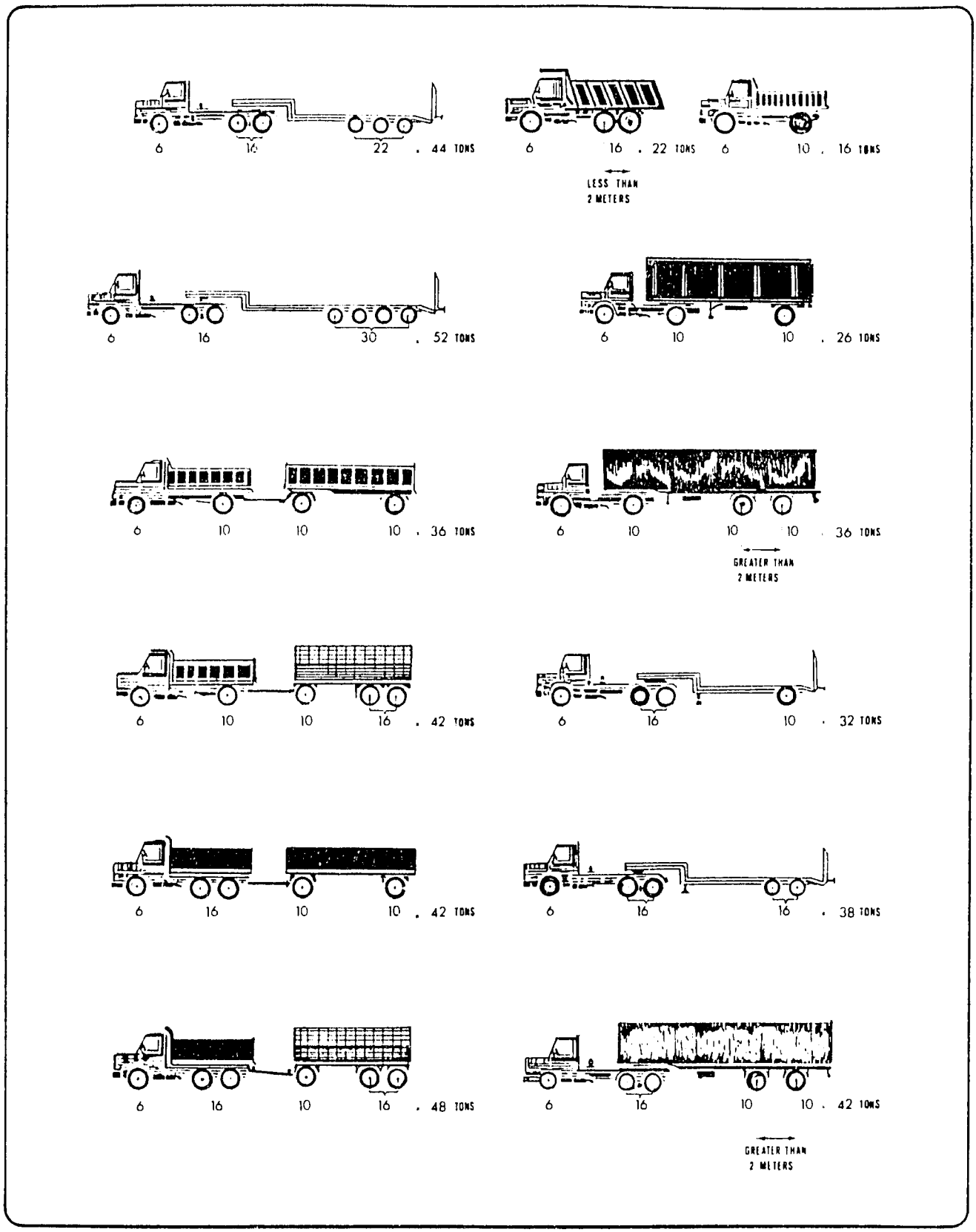
About 41 percent of tractor units on articulated trucks had a tandem rear axle; the rest had two single axles. The most common semi-trailer had two spread rear axles (greater than 2 meters apart) and these accounted for nearly one third of all semi-trailers. Less than 1 percent had three spread axles, but tridem rear axles accounted for 18 percent of the total.

In total, excluding truck front axles which were almost all single axles with a single wheel at each end, the distribution of axles by type as observed in the truck weighing survey was as follows(virtually all with dual wheels at the end of each axle):

Singles	3477	(84%)
Tandems	617	(15%)
Tridems	43	(1%)
TOTAL	4137	(100%)

Truck Loading Characteristics

While there can be some questions about the determination of licensed vehicle weights, there can be little doubt about the findings of the Truck Weighing Survey which indicates that an exceedingly large proportion of trucks on the Cairo-Assuit highway are grossly overloaded.



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LEGAL AXLE LOADS IN EGYPT

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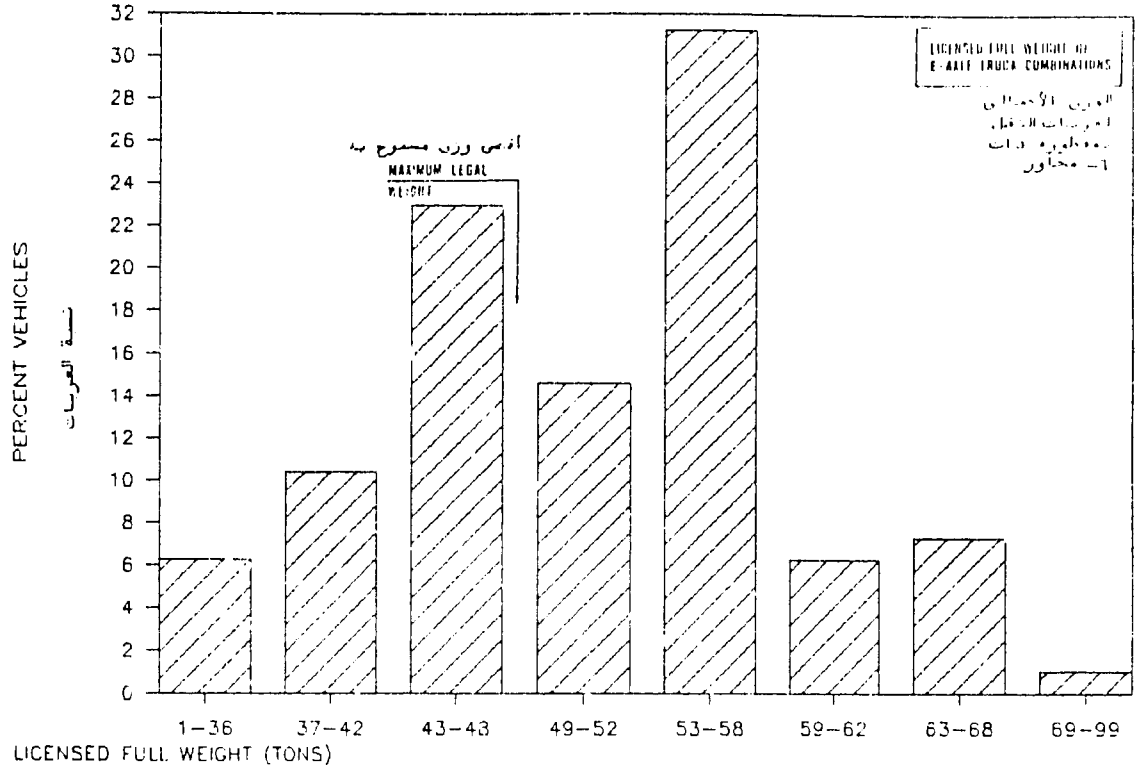
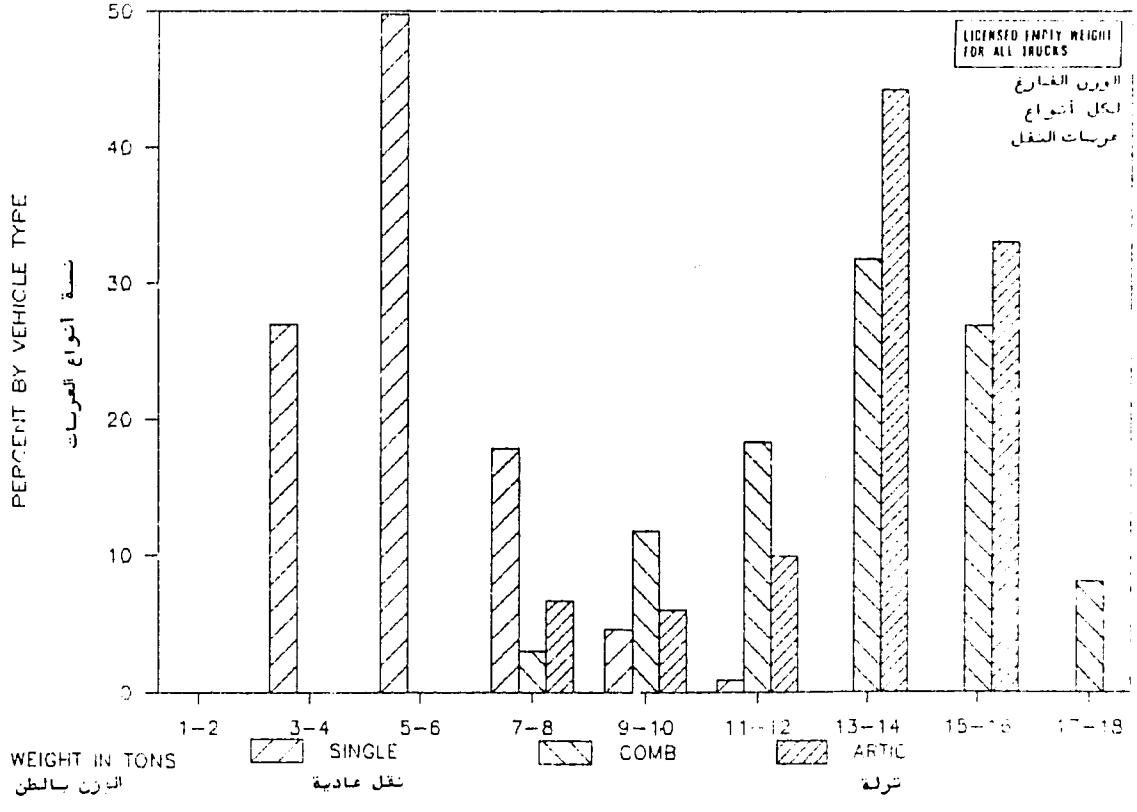
Figure 28-4





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LICENSED WEIGHTS OF TRUCKS

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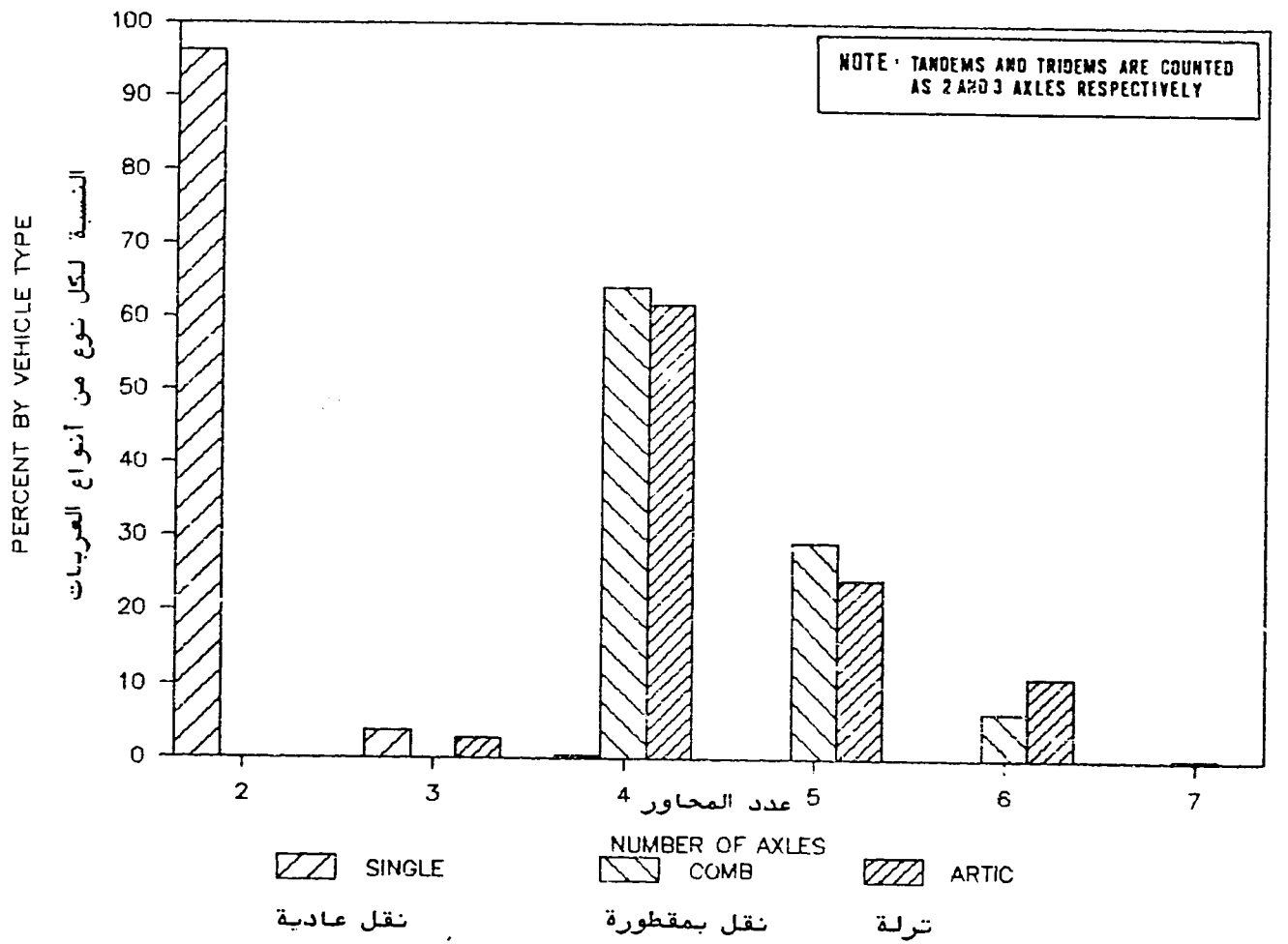
Figure 2B-5



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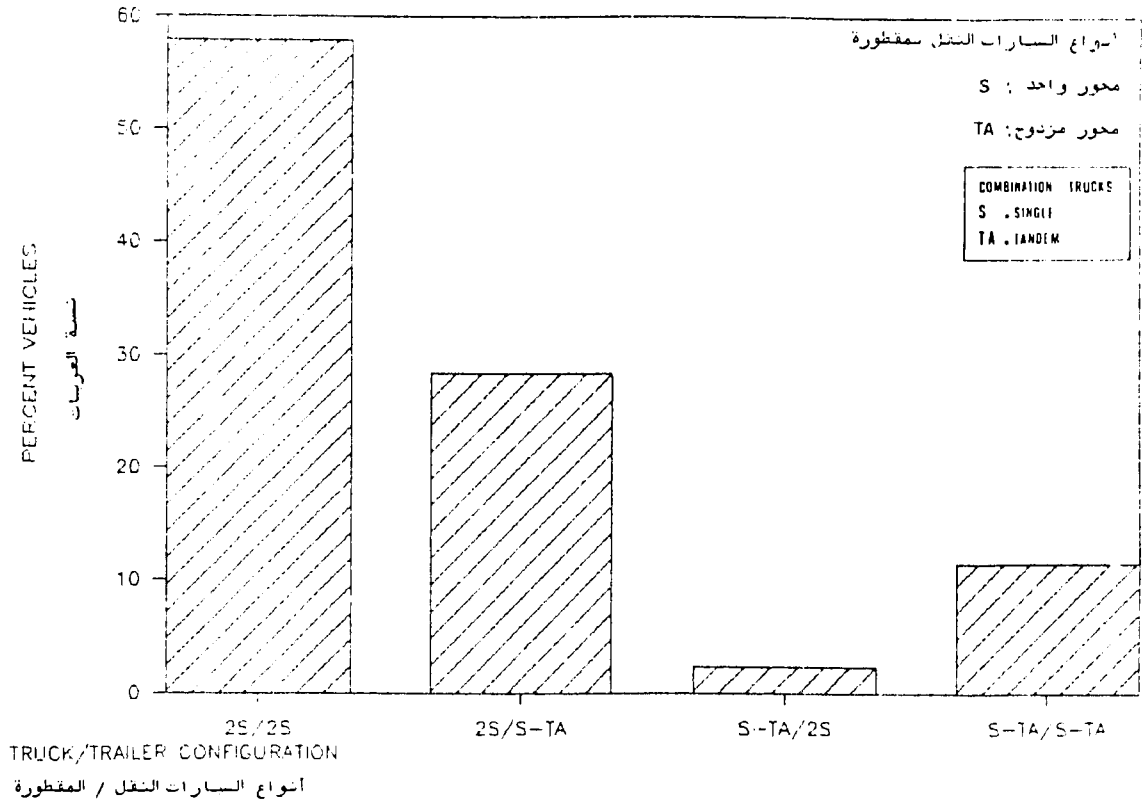
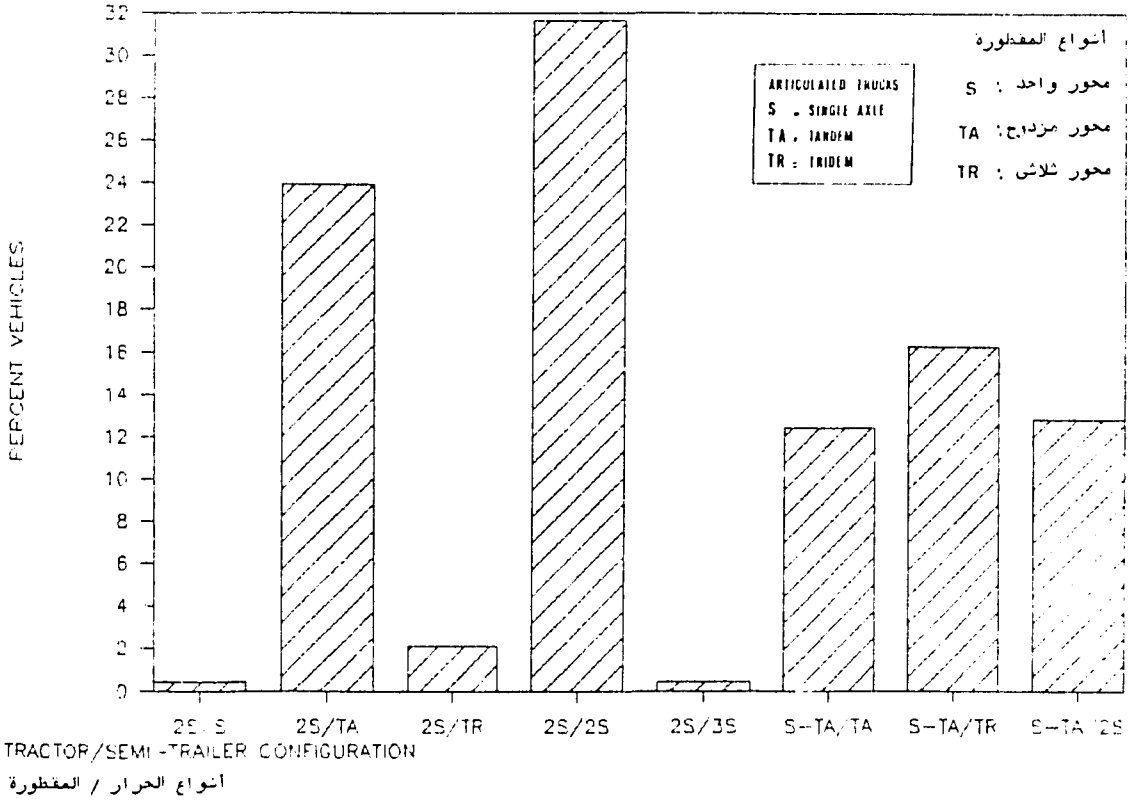
NUMBER OF AXLES BY TRUCK CLASS

Figure 2B-6





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TRUCK CONFIGURATIONS

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Figure 2B - 7

Figure 2B-8 shows the total weights of all loaded trucks measured in the Truck Weighing Survey. It can be estimated that about 75 percent of the combination and articulated trucks, and about one third of all single trucks exceed the maximum permitted load, many by a considerable margin.

Trucks carrying particular commodities were more heavily loaded than others. Figure 2B-8 also shows a comparison of truck weights for those carrying cement and those carrying fruit and vegetables. Clearly, the cement trucks were very much more heavily loaded, essentially because bags of cement are very dense and many bags can be loaded onto a vehicle with little difficulty. The average combination truck loaded with cement (and about 90 percent of all cement is carried in this type of truck) weighed 63 tons, and 28 percent of these weighed over 70 tons.

Anyone who doubts these weights can readily observe cement trucks passing through Cairo at night. It is common to see as many as 1300 bags on a combination truck, 800 on the trailer (20 rows, 4 across and 10 deep.) and 500 on the truck (which has less "capacity" because of the driver's cab. Each bag weighs a standard 50 kgs, giving a total load of 65 tons. With an empty weight of 15 tons, this gives an 80 ton truck. Some can be observed more heavily loaded than this. For example one truck combination was observed in Minia carrying about 2000 bags of cement giving a load at 100 tons.

The scales used to measure the loads were calibrated by the manufacturer's agent before the survey. A further check on the scales is given by the weights recorded for empty trucks (see the initial printouts of the Truck Weighing Survey in Appendix 1H). For single trucks, 124 out of 141 weighed where a comparison can be made gave a weight within one ton of the licensed empty weight. Even if there was some error in the scale readings, it is unlikely the degree of overloading reported is seriously mis-reported.

A closer view of the overloading situation is given in Figure 2B-9. This shows, for all loaded trucks, the measured loads on single axles (excluding front axles), and tandem axles. About 60 percent of single axles, and and astonishing 81 percent of tandem axles were found to be overloaded. About 63 percent of tridem axles (not illustrated) were found to be overloaded also.

Consequences of Truck Overloading

Much investigation has been undertaken into the effect of axle loads on pavements, and most work has been based on the AASHO tests conducted in the United States reported in 1962. The original investigations derived an axle damage law which relates pavement damage to the fourth power of the axle load. This means that if a normal axle is overloaded to twice its proper load, 16 times more damage will done to a road pavement.

Subsequent research has indicated different exponents (powers) ranging between 3 and 6, with the higher exponents linked to weaker pavements and to higher axle loads (for example, roads with a high proportion of

overloaded axles). The most commonly used formulations of the axle damage law now use an exponent of the order of 4.5 to 5.0. These indicate that doubling an axle load results in between 20 and 30 times the damage to the pavement compared with a normal axle.

It can therefore be appreciated that control of axle loads is fundamental to the preservation of highways. Axle load enforcement is standard practice in developed countries; although overloading occurs, it is of the order of perhaps 5 to 10 percent over legal axle loads for a small proportion of vehicles.

For example, Figure 2B-10 compares the results of this Study with an axle load survey carried out in city of Hull (Great Britain) in 1980. The study was of a road with a high proportion of industrial traffic since Hull is a major port. For this comparison, all axle loads were converted to single axle loads by dividing the weights of tandems and tridems by 2 and 3 respectively. The legal axle load in Great Britain approximates to 10 tonnes per axle which is the same as Egypt. The Hull survey recorded only 2.7 percent of axles over 10 tonnes compared with 60 percent in Egypt.

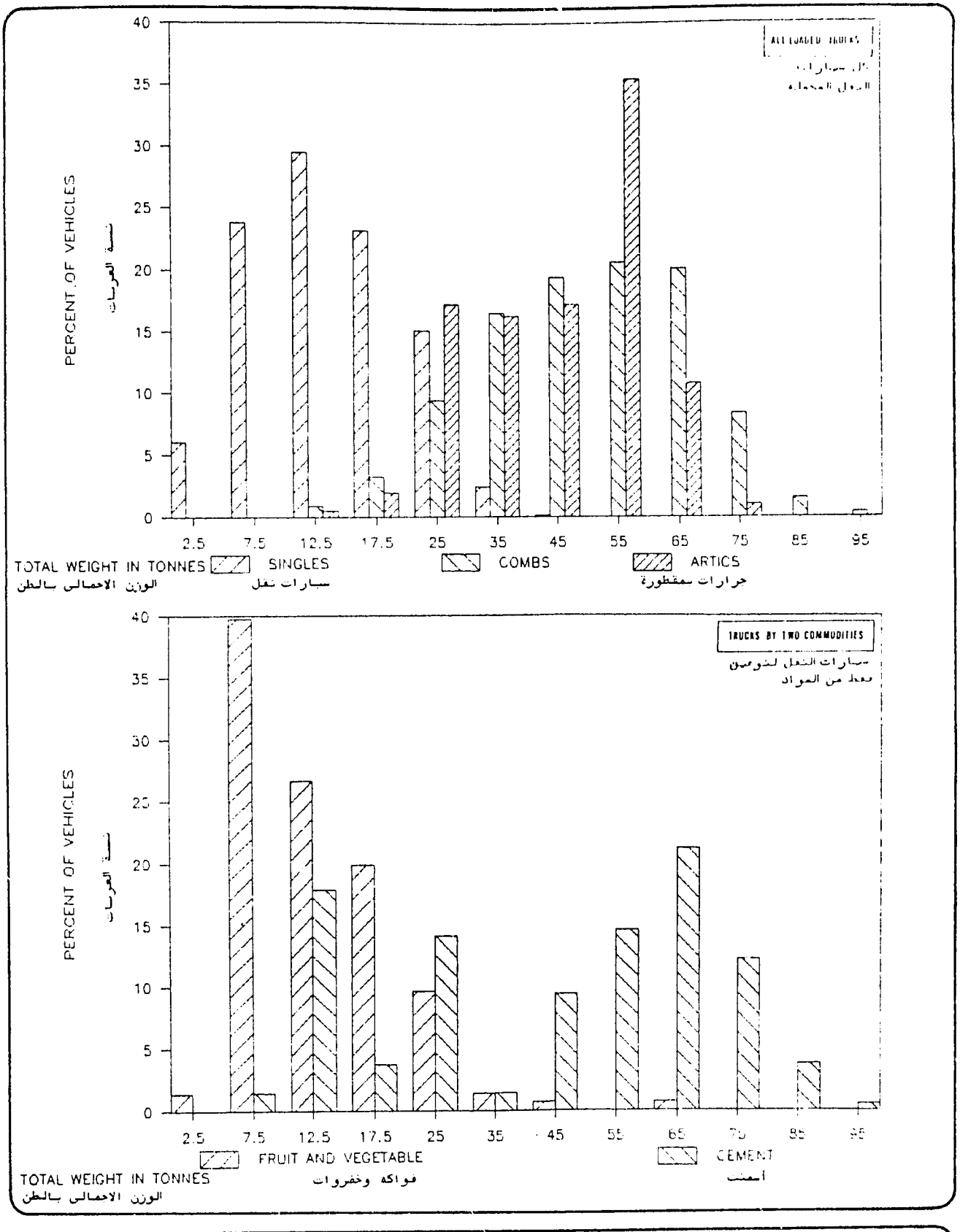
Figure 2B-10 also presents a comparison of the relative damaging effects of trucks assuming different axle loadings prevalent in Egypt in other years, and in both the USA (Asphalt Institute Design Manuals) and the UK (The Hull Survey reported above, and a Transport and Road Research Laboratory Design Note). For the purpose of the comparison, the average 24-hour traffic stream passing roadside interview station R09 (Malatea, on the boundary between Beni Suef and Minia) was converted into equivalent standard axles, a normal measure of the damaging effect of trucks. Estimates of daily standard axles for each situation were made by applying average values of standard axles per truck taken from surveys or design manuals.

The resulting graph dramatically illustrates the extreme pavement damaging power of trucks in the Cairo-Assuit corridor compared with the same number of trucks in the other situations illustrated.

Implications for Pavement Design - These are very serious. The data indicated a strong directional bias in the flows with the heaviest trucks being southbound. The southbound lane was estimated to be carrying 14,000 standard axles per day, which implies an accumulation of up to 200 million standard axles over a design life of the next 20 years. Some standard design procedures (eg Road Note 29 issued by the British Department of the Environment) consider that 90 million standard axles is the highest practical volume to design for, and the USA Asphalt Institute design charts do not consider lifetime loadings above 100 million standard axles.

Highway Transport Volumes

Figure 2B-11 shows the daily tonnages recorded in the corridor. A total of nearly 73,000 tons per day was recorded, implying an annual tonnage of about 27 million tons per year.



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TOTAL WEIGHT OF LOADED TRUCKS

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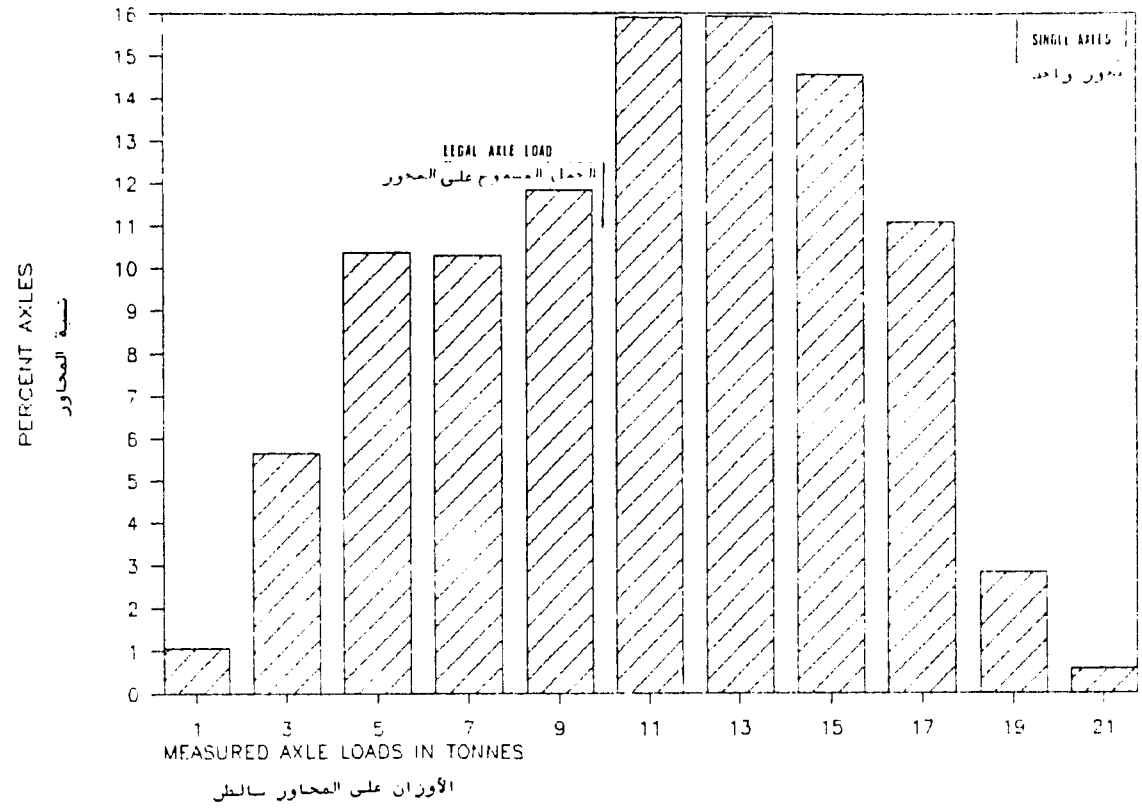
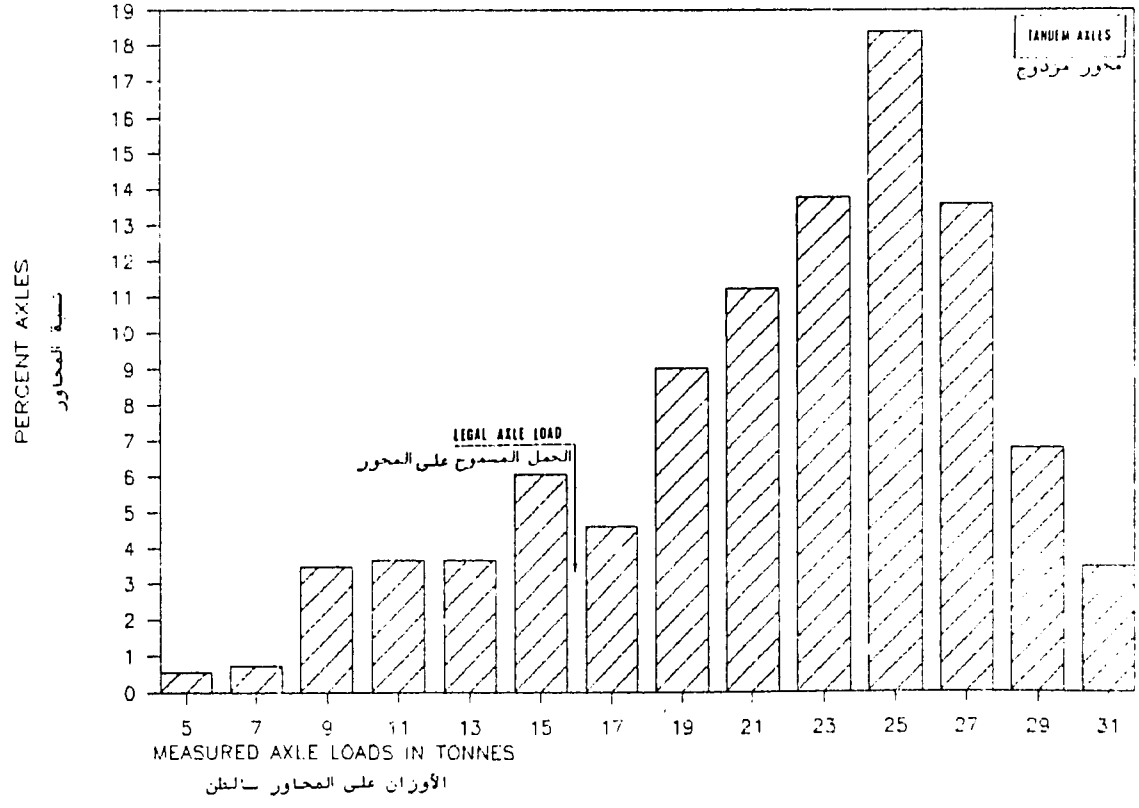
Figure 2B - 8





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AXLE LOADS FOR LOADED TRUCKS

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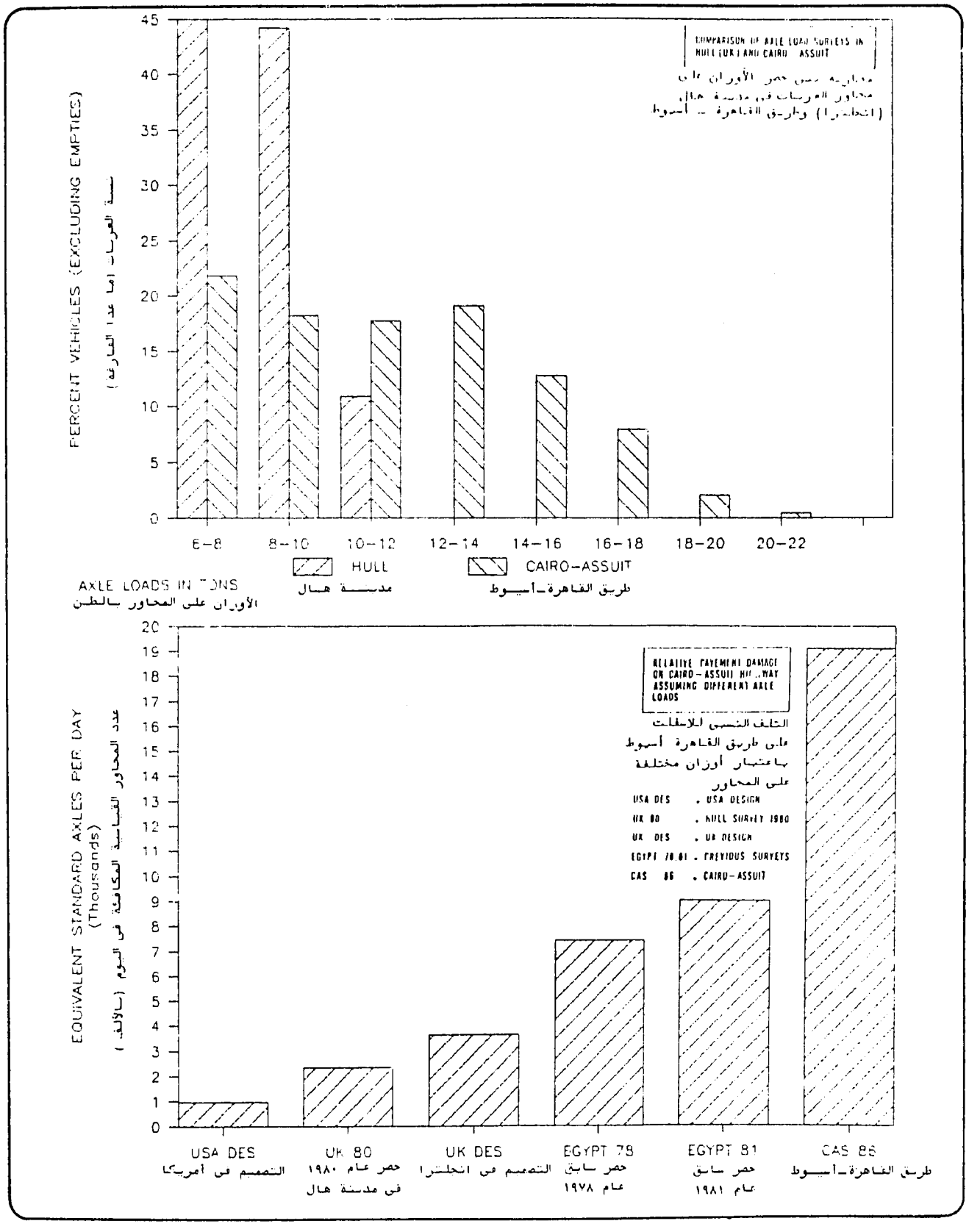
Figure 2B - 9



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AXLE LOAD COMPARISONS AND RELATIVE PAVEMENT DAMAGE

Wilbur Smith and Associates
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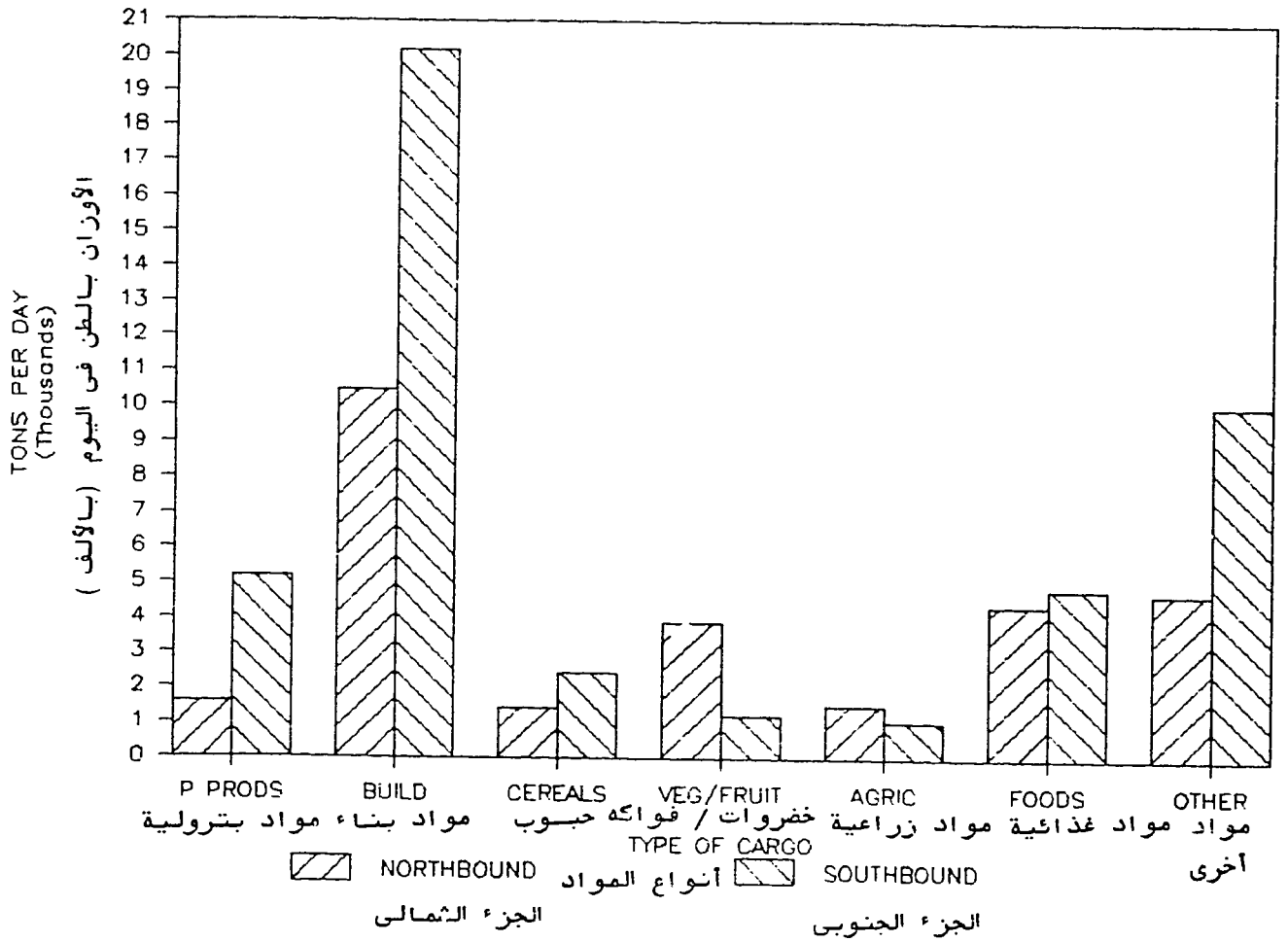
Figure 2B-10



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CARGO TRANSPORTED BY ROAD

Figure 2B – 11

There was a very strong directional bias with about 45,000 tons daily moving south, compared with 28,000 tons per day moving north. Also, the mix of commodities was very different for the two directions. The southbound movements were dominated by building materials (much of which was cement) and other products of a heavy industrial nature. The northbound movements were also dominated by building materials, but had a higher proportion of food and agricultural products.

A total of 416,000 passengers per day were recorded in the corridor, evenly divided between the two directions. This amounts to about 152 million persons movement per year in the corridor.

Trip Length Distribution

Figure 2B-12 shows the distribution of total movements in the corridor by journey length. This clearly demonstrates that the great majority of trips were short distance with over one half of 30 kilometers or less.

There was great variation in journey length between the different vehicle types. Figure 2B-13 shows the individual journey length distributions for passenger vehicles and Figure 2B-14 shows the results for pickups and trucks. Average journey lengths are shown below:

1.	Car work	49 kilometers
2.	Car other	57
3.	Taxi van	67
4.	Taxi car	30
5.	Pickup	70
6.	Bus	65
7.	Truck single	73
8.	Truck combination	204
9.	Truck articulated	215

Most passenger vehicles had relatively short journey lengths with only about 5 percent exceeding 150 kilometers. Taxi vans showed the shortest journeys with few more than 60 or 70 kilometers and most under 20 kilometers. Single trucks and pickup movements were also predominantly short, although approaching 9 percent for both vehicle types exceeded 150 kilometers. The large multi-unit trucks, on the other hand, showed much longer journeys, with 2 percent of journeys as long as 800 kilometers.

Movement Patterns in the Corridor

Figure 2B-15 illustrate the relative size of movements between the Governorates and Figure 2B-16 shows the volumes of external movements to and from the corridor. The volumes shown are average 24 hour daily volumes in vehicles.

It can be appreciated from Figure 2B-15 that in terms of traffic movements, the Governorates in the corridor were very self-contained, with the bulk of all movements taking place entirely within each Governorate.

In fact, the volume of movements entirely within Governorates represented almost 50 percent of all movements observed in the corridor, considering all internal and external movements together.

Movements between Governorates in the Corridor represented only about 7 percent of all trips, and the great majority of these were to the adjoining Governorate. For example, few jouneys were observed between Assuit and Fayoum, or between Minia and Giza (that part in the corridor).

External Corridor Movements - Figure 2B-16 shows that most external movements to and from the Cairo-Assuit Corridor were associated with Greater Cairo and the North. There were strong movements into Giza and Fayoum, and the movements to Beni Suef, Minia and Assuit were substantial. As could be expected, the strongest movements were between the closer Governorates, with volumes tailing off as they went further south down the corridor. External movements to and from the North represented nearly 25 percent of all traffic in the corridor. Only one third of this (about 7.5 percent of all corridor traffic) was truly long distance passing beyond Fayoum and Giza.

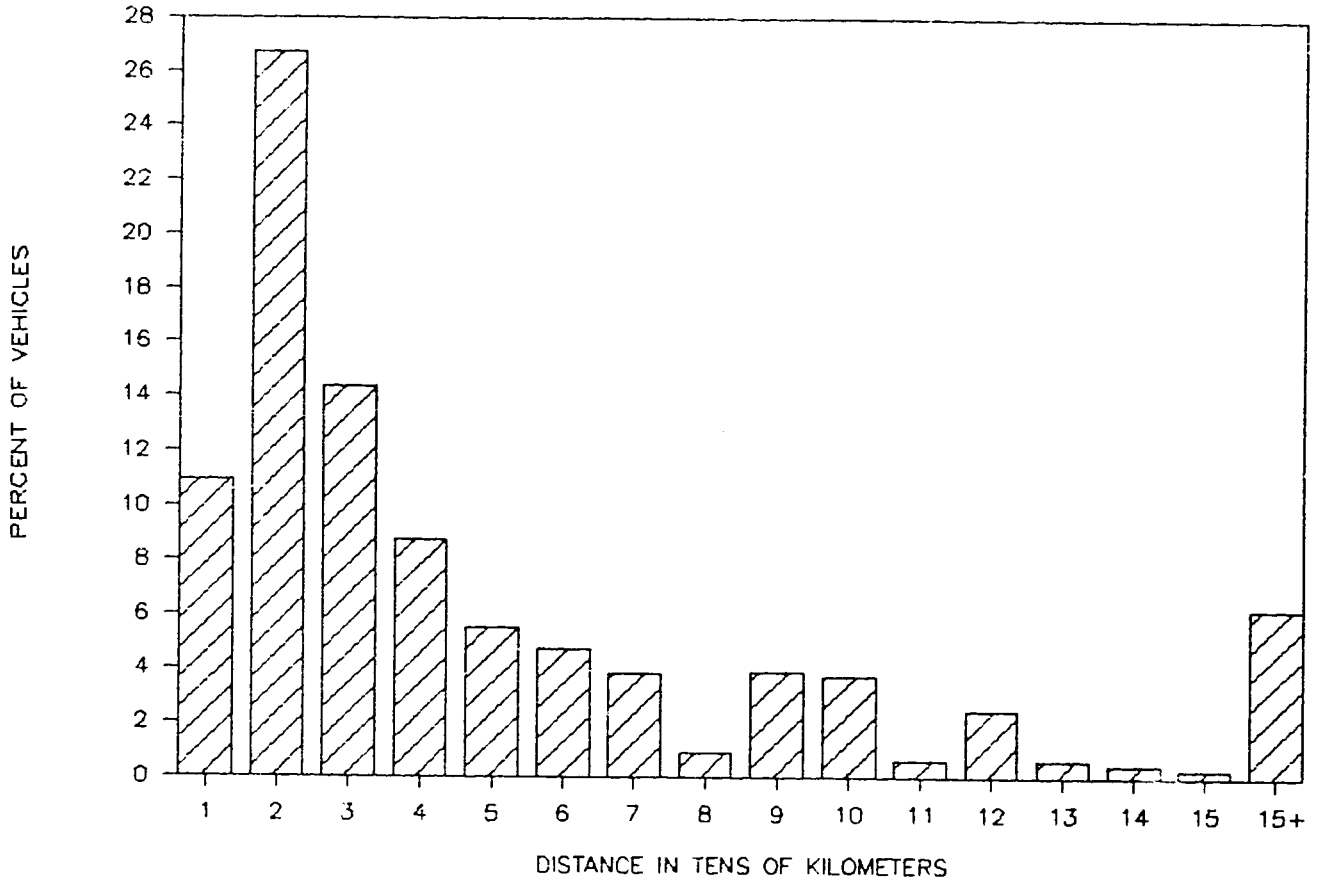
Movements between the corridor and the South (rest of Assuit Governorate, Upper Egypt, New Valley and the Red Sea) were much lighter. By far the largest part of this movement was traffic into and out of Assuit, most of which were movements within Assuit Governorate which was cut in two by the Study Corridor boundary. There was very little interaction between the South and the rest of the Corridor.

Through movements passing along the corridor without intermediate stops were significant, although representing less than 2 percent of all traffic in the corridor.

Movement Origins and Destinations

Nearly 80 percent of the movements intercepted in the interview survey started or finished their journeys within the corridor. The percentage distribution by location of the main origins and destinations outside the corridor are shown in Figure 2B-17. About 65 percent of the passenger and pick-up vehicles started or finished in the Greater Cairo area, and about 30 percent started or finished in Upper Egypt south of Assuit. The remaining trips starting or finishing outside the corridor were associated mainly with the Delta area, in particular Alexandria.

The pattern for trucks was quite different, with nearly 20 percent of origins and destinations outside the corridor associated with port cities: Alexandria (10 percent), the Red Sea (0.6 percent probably to the port of Safaga),and other ports (3 percent). The remaining truck traffic was distributed 53 percent to Cairo, 26 percent to Upper Egypt and 8 percent to the Delta.



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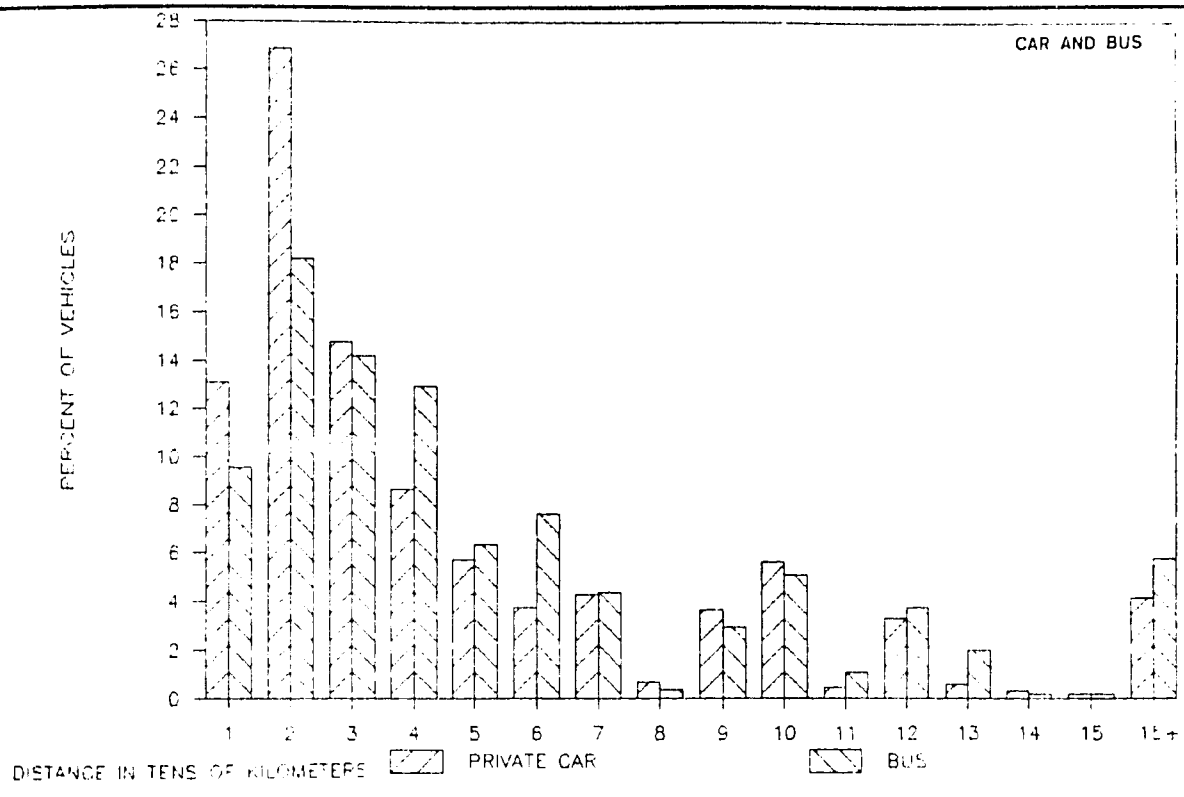
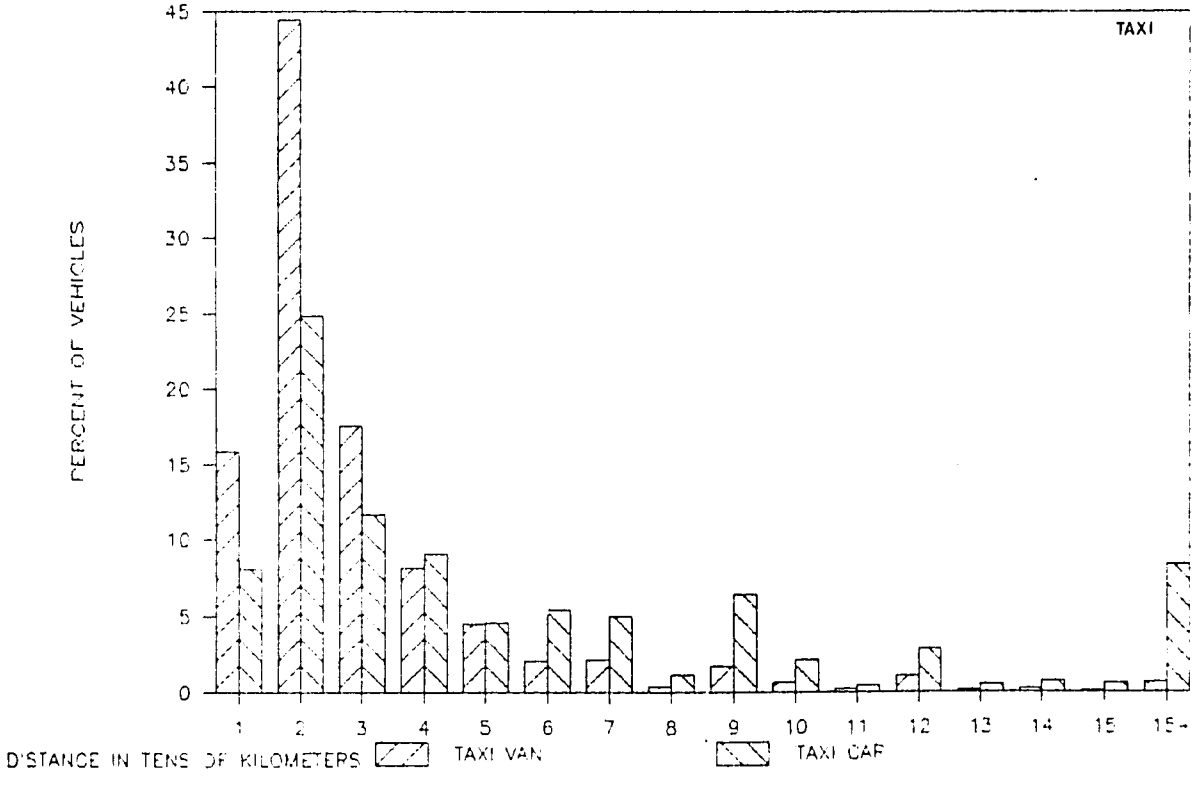
JOURNEY LENGTH DISTRIBUTION ALL VEHICLES

Figure 2B - 12





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JOURNEY LENGTH DISTRIBUTION

PASSENGER VEHICLES

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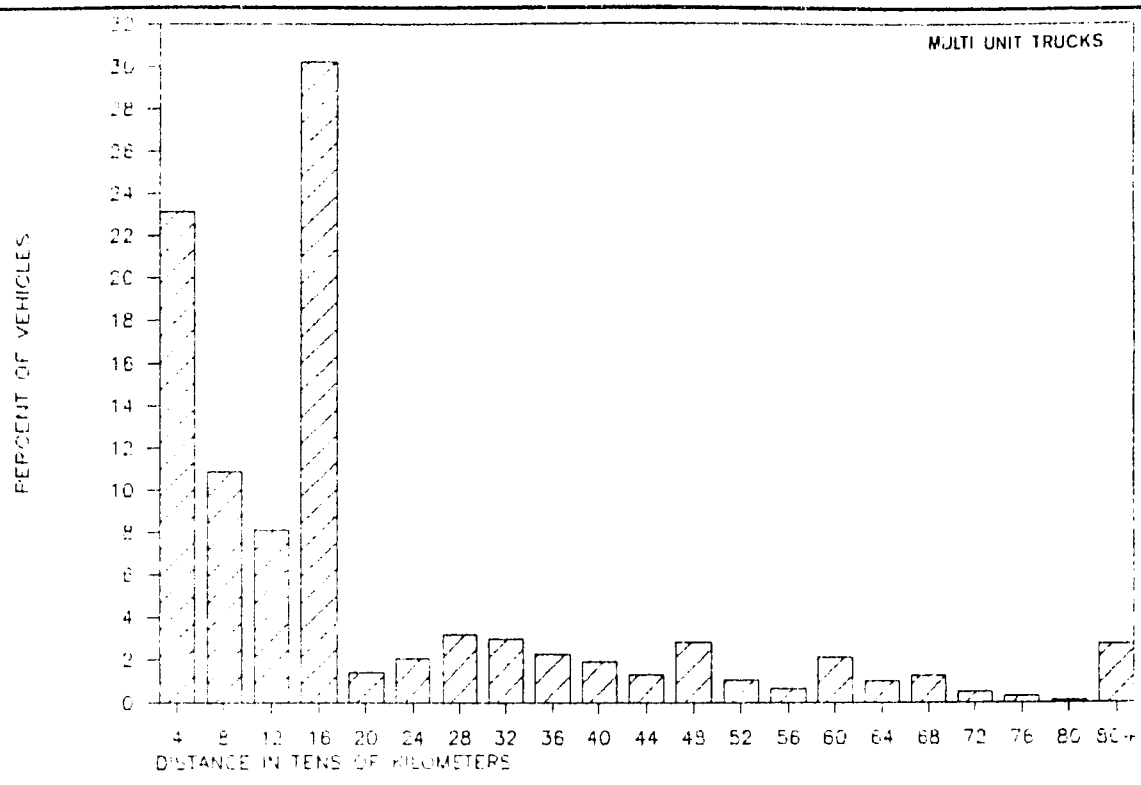
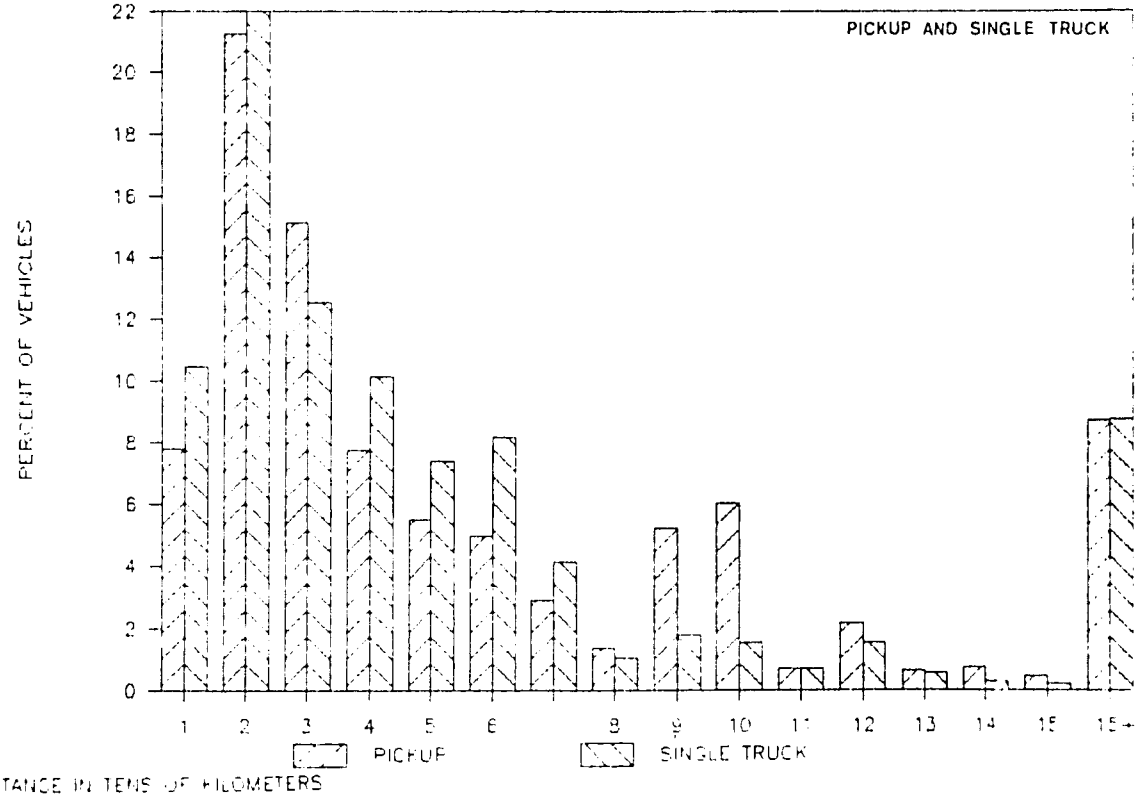
Figure 2B-13





Cairo – Assuit Highway Feasibility Study

JOURNEY LENGTH DISTRIBUTION
CARGO VEHICLES

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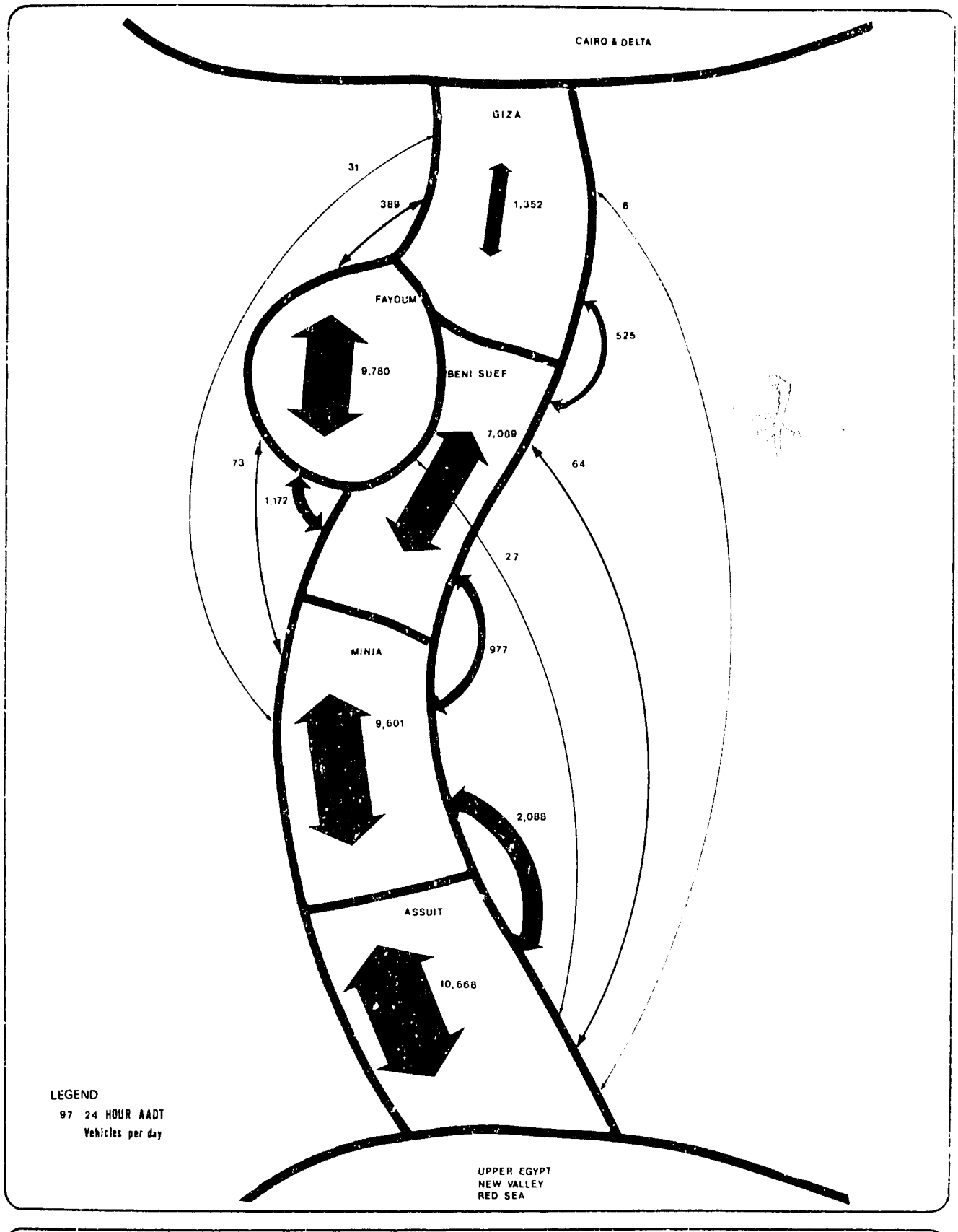
Figure 2B - 14



Cairo – Assuit Highway Feasibility Study

MOVEMENTS WITHIN THE CAIRO-ASSUIT CORRIDOR

(1985 / 1986)

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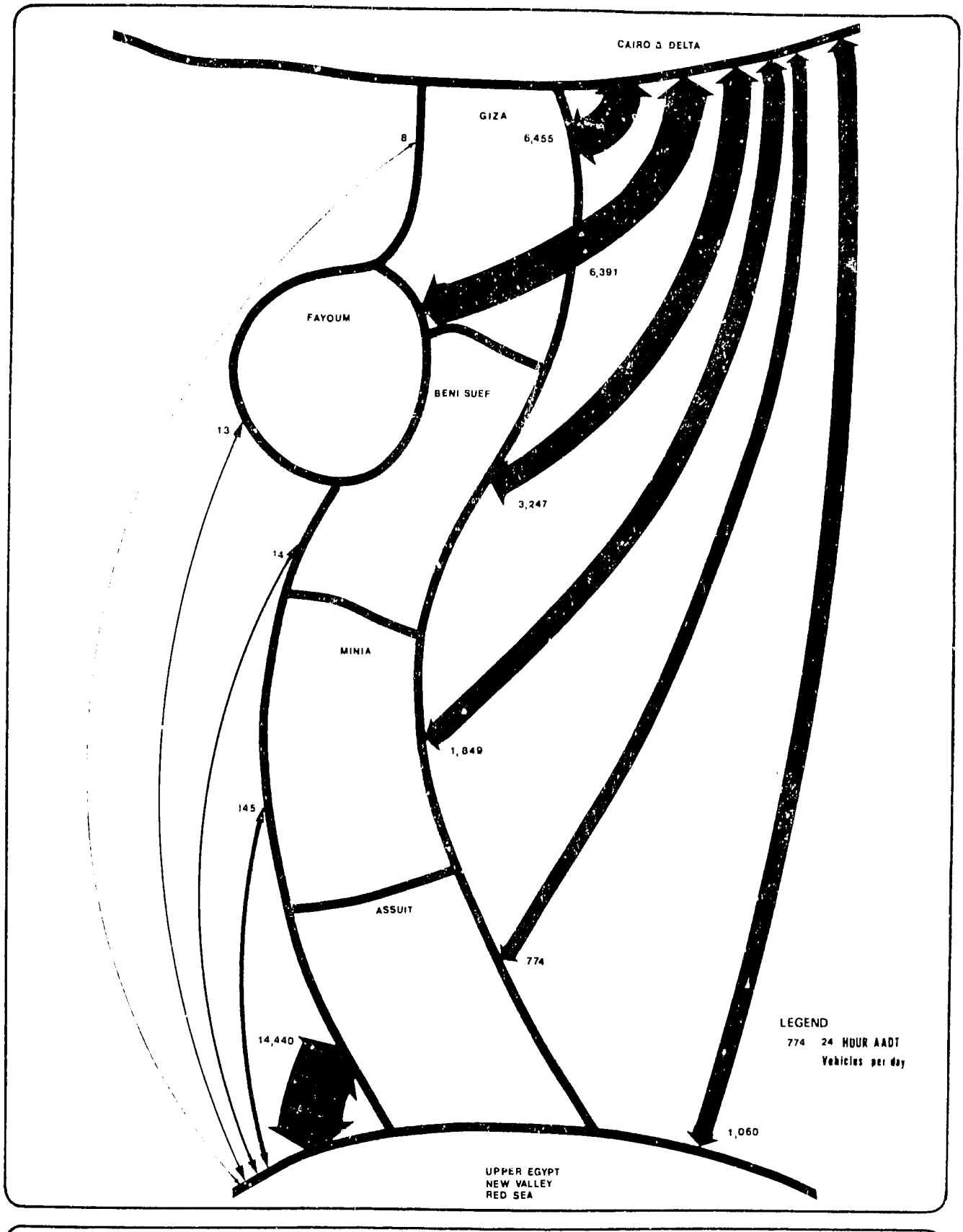
Egyptian Consultants Consortium

Figure 28-15



Cairo – Assuit Highway Feasibility Study

MOVEMENTS TO AND FROM CAIRO-ASSUIT CORRIDOR

(1985 / 1986)

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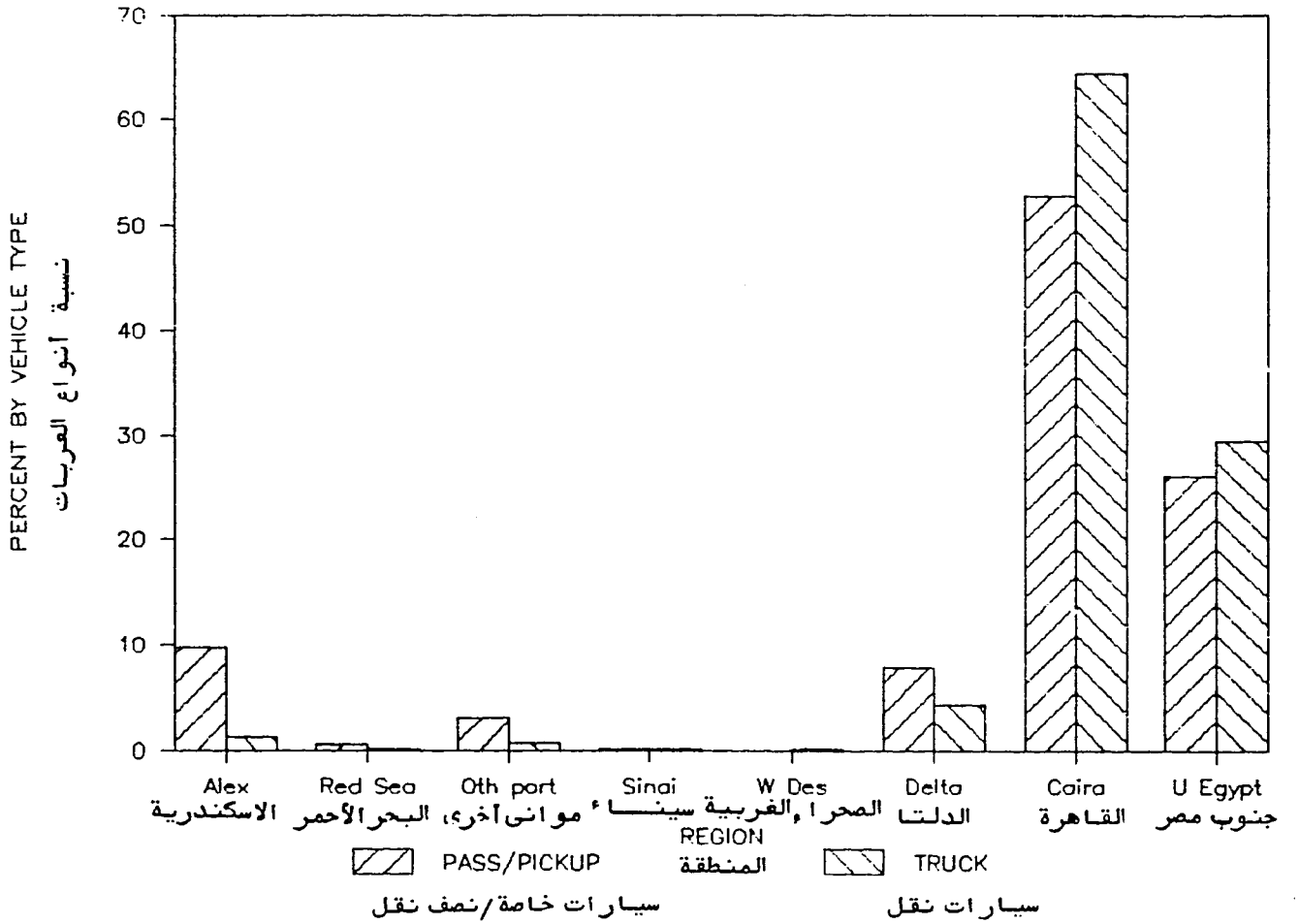
Egyptian Consultants Consortium

Figure 28-16



Cairo – Assuit Highway Feasibility Study

ORIGINS AND DESTINATIONS OUTSIDE THE STUDY CORRIDOR

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Figure 2B - 17

Appendix 2C

TRAFFIC ACCIDENTS AND ACCIDENT COSTS

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Appendix 2C

TRAFFIC ACCIDENTS AND ACCIDENT COSTS

Accident Statistics

With the exception of that portion of the existing Upper Egypt road within Giza Governorate, accident statistics for the study corridor are gross estimates, unsuitable for precise analysis techniques. Table 2C-1 presents available statistics.

The Fayoum-Giza desert road appears to experience a smaller percentage of fatal accidents compared to the main west bank Cairo-Assuit Highway and the Governorates within the study corridor. Table 2C-2, which presents a detailed break-down of accidents by category, suggests a possible rationale for this difference. This table indicates pedestrians were involved in about 64 percent of the fatal accidents. Compared to the desert road, pedestrian crossings and junctions are considerably more numerous on the Cairo-Assuit Highway. The fact that the first 25 kilometers of the Cairo-Assuit Highway within the Giza Governorate is a four-lane divided highway explains the quite low (0.18) accident rate on this section.

Accident Rates

Combining preliminary traffic results with average accident data yields the accident rates as set out in Table 2C-3. The rates estimated appear reasonably in agreement with rates estimated in other developing countries (2.30 in a Kenya study and 2.64 in a Jamaica study). The basic accident statistics for the Governorates of Minia and Assuit included all road accidents within the Governorates. Therefore, accidents attributable only to the Cairo-Assuit Highway had to be estimated and these rates are of more questionable reliability.

The existing valley road has many intersections and passes through numerous settlements with their attendant pedestrian traffic. A significant reduction in accident rates is associated with the divided highway portion and the Giza-Fayoum desert road. Evidence from other countries indicates that 4 to 6 percent of all personal injury accidents result in a fatality. Within the Cairo-Assuit corridor, about 36% of the injury accidents produces a fatality, mainly attributable to the heavy pedestrian traffic.

In the United States, injury accident rates as low as 0.164 per million vehicle kilometers have been estimated for multi-lane divided highways with controlled access. Rural 2-lane paved roads are estimated at 0.515. Studies of accident rates in developing countries indicate the injury accident rate is considerably higher (by a multiple of 3 to 6) than in developed countries for similar levels of traffic flow and geometric design. This information was derived from UK Transport and Road Research Laboratory (TRRL), Report 434, "Further Research on Accident Rates in Developing Countries"(Reference 10).

Table 2C-1

VEHICLE ACCIDENTS - UPPER EGYPT

LOCATION	ACCIDENTS				PERCENT OF TOTAL		
	Fatal	Injury	Damage	Total	Fatal	Injury	Damage
Within Governorate of Beni-Suef, Minia, Assuit, Sohag, Qena, Aswan(Av.1980-84)	1045	3037	1595	5677	18.4%	53.5%	28.1%
Within Governorates of Beni-Suef, Minia, Assuit(Av.1980-84)	366	974	694	2034	18.%	47.9%	34.1%
Giza South(0-70km) Cairo-Assuit Highway(1985)	28	65	42	135	20.7%	48.1%	31.2%
Giza South(0-160km) Cairo-Assuit Highway(Av.1983-84)(1)	20	-	108 -	128	15.6%	-	84.4% -
Fayoum Desert Road (Av.1980-84)	10	68	39	117	8.5%	58.1%	33.4%
Cairo-Assuit Highway Beni-Suef(Av.1980-85)	120	382	232	734	16.4%	52.0%	31.6%

SOURCE: Central Traffic Agency

(1) Injury and damage data were not separated

Table 2C-2

VEHICLE ACCIDENTS ON THE CAIRO-ASSUIT HIGHWAY
(GIZA SOUTH 0-70 KM, 1985)

Classification	Accidents	Percent of Total Accidents
Fatal		
Night-Pedestrian	6	4.4
Other	2	1.5
Day-Pedestrian	8	5.9
Other	6	4.5
Sub-Total	22	16.3
Injury		
Night-Pedestrian	6	4.4
Other	14	10.4
Day-Pedestrian	29	21.5
Other	26	19.3
Sub-Total	75	55.6
Damage Only	38	28.1
TOTAL	135	100.0
(Total Pedestrian)	49	(36.3)

SOURCE: Central Traffic Agency

Table 2C-3

ESTIMATED ACCIDENT RATES

LOCATION	ACCIDENTS INVOLVING INJURY (per million veh.-kms)
Existing Cairo-Assuit Highway	
Giza Governorate	
0-25 kilometers (divided highway)	0.18
25-70 kilometers	0.45
Beni-Suef Governorate	1.40
Minia Governorate	1.40
Assuit Governorate	2.71
Giza-Fayoum Desert Road	0.28

Considering the incomplete and gross nature of the vehicular accident data within the corridor, the analysis results are suitable as indicative guidelines only. Based on experience and data from developing countries, the following rates were adopted for use in evaluating the proposed highway infrastructure improvements within the Cairo-Assuit Corridor.

ROAD TYPE	INJURY ACCIDENT RATE (Million Vehicle Kms) Injury Only	Fatality
2 Lane valley road (with numerous intersections and pedestrian traffic)	1.20	0.30
2 Lane desert road	0.520	0.030
4 Lane divided	0.247	0.016

Costs of Traffic Accidents

This section presents an estimate of the cost per highway accident in terms of fatality, injury and property damage. Consultants have been unable to locate any research on this subject directly applicable to highway accidents within Egypt.

Fatality - Various approaches have been employed in the analysis of the cost of traffic accident fatalities, ranging from the use of insurance records of payments through estimates of gross or net loss of output. A TRRL report "Comparative Accident Costs in Developing Countries" (Reference 9) presents a survey of methodology and results for some eight studies of accident data in developing countries. There is no general concensus on the appropriate methodology to be employed when estimating the cost of accidents.

This Study adopted the use of a gross valuation for measuring output cost as the result of a traffic accident. The following assumptions were tested and appear reasonable:

- o 30 years - remaining life expectancy
- o L.E. 525 - average per capita gross domestic product.
- o 9 percent - social discount rate.

The above assumptions yield a cost per fatality of LE 5,879. If life expectancy were increased to forty years and the social discount rate were decreased to 6 percent, the cost would increase to LE 8,373. The above referenced survey (Reference 9) yielded an average per-fatality cost of LE 6,200 for the developing countries covered, but this figure should be regarded as a gross order of magnitude measurement as the estimates are not directly compatible. Dis ussions with Egyptian insurance officies disclosed an average payment per fatality of about LE 8,000. Compulsory insurance sets a top limit of LE 10,000 per fatality. A cost per fatality

of LE 6,000 was adopted for evaluation purposes. This value is considered reasonable when balanced against the considerable uncertainty of the average age at death, social discount rate, and Gross National Product estimates.

Personal Injury and Property Damage - Using the relationships between cost per fatality, personal injury and property damage contained in the TRRL survey report, the following costs were assumed:

- o LE 1670 - Personal injury per accident involving serious personal injury,
- o LE 190 - Personal injury per accident involving slight injury,
- o LE 1450 - Property damage per accident involving personal injury,
- o LE 680 - Property damage per accident involving no personal injury.

Appendix 2D

ROAD TRANSPORT SERVICES

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Appendix 2D

ROAD TRANSPORT SERVICES

This Appendix reviews the organization and operation of freight and passenger road transport services, and the development of the vehicle fleet is delineated. 1985/86 freight and passenger tariffs are also detailed.

Vehicle Fleet

Table 2D-1 presents the growth and regional distribution, by vehicle type, of the National vehicle fleet. Registration has tended to concentrate in the major cities which had 70.7 percent of the total fleet, with Cairo accounting for 40 percent of the total, in 1985/86. This concentration decreased only a few percentage points in the last decade. The rate of increase for the total fleet has been very high for the last decade, averaging in the neighborhood of 16.5 percent per year. In particular, the truck category increased at an average rate in excess of 21 percent per year during the ten year period.

Table 2D-2 summarizes the average annual growth of the fleet from 1965 to 1985/86.

Table 2D-2

AVERAGE ANNUAL GROWTH OF THE VEHICLE FLEET

	VEHICLE TYPE					
PERIOD	Private Car	Taxi	Total Pass.Car	Bus	Truck	Total Fleet
1965-70	5.7%	7.9%	6.6%	4.5%	2.5%	5.8%
1970-75	7.3%	22.2%	9.7%	7.0%	9.7%	9.6%
1975-79	16.6%	11.0%	15.2%	11.6%	25.4%	16.7%
1979-84	17.0%	13.1%	16.1%	11.9%	21.2%	17.0%
1984-85/86	15.2%	9.8%	14.1%	11.2%	12.7%	13.7%

The taxi growth rate was highest during the 1970-75 period. Truck growth was most intense from 1975 to 1979, while private car and bus rates remained strong through 1984. The growth rate in the vehicle fleet slowed down for all vehicle groups in the two years prior to this Study.

Passenger Transport

Interurban road passenger transport in Egypt was supplied by four public bus companies and numerous private sector inter-city shared taxi services. In addition, many employers (including government) provide home-to-work transport for their employees.

Table 2D-1

GROWTH IN THE EGYPTIAN VEHICLE FLEET

	PRIVATE CAR			TAXI			BUS			TRUCK			TOTAL		
	1979	1984	85/86	1979	1984	85/86	1979	1984	85/86	1979	1984	85/86	1979	1984	85/86
Major Cities															
Cairo	145,276	307,702	381,658	23,762	40,245	46,349	6,999	12,520	14,694	28,068	58,919	70,618	204,105	419,386	513,319
Giza	42,739	95,350	118,267	11,422	20,854	24,017	778	1,699	1,944	8,261	24,266	29,081	63,200	142,169	173,309
Alexandria	49,756	110,227	136,720	13,480	29,121	33,537	2,540	4,235	5,021	16,990	34,765	41,668	82,766	178,340	216,946
Sub-total	237,771	513,279	636,645	48,664	90,220	103,903	10,317	18,454	21,659	53,319	117,950	141,367	350,071	739,903	903,574
Canal															
Sub-total	9,073	20,360	25,254	5,294	9,528	10,973	636	1,126	1,322	4,177	11,888	14,248	19,135	42,902	51,797
Delta															
Damietta	2,010	3,589	4,452	1,449	2,446	2,817	125	159	187	1,184	3,595	4,309	4,768	9,789	11,765
Sharkia	3,850	6,605	10,673	2,302	3,049	3,511	233	303	356	3,668	7,887	9,453	10,053	19,844	23,993
Dakahlia	5,400	12,390	15,368	5,600	7,693	8,660	421	463	543	4,660	12,020	14,407	16,081	32,566	38,978
Beheira	3,305	4,738	5,877	3,012	4,698	5,410	173	471	553	3,098	12,386	14,485	9,588	22,293	26,325
Gharbia	4,461	13,551	16,808	3,543	7,693	8,660	582	1,050	1,232	3,607	13,703	16,424	12,193	35,997	43,124
Minufia	1,756	6,785	8,416	1,683	5,256	6,053	255	430	505	1,390	6,351	7,612	5,084	18,822	22,586
Kafr el Sheikh	923	2,557	3,172	1,587	2,647	3,048	172	402	472	1,263	5,201	6,234	3,945	10,807	12,926
Kalyubia	2,455	8,347	10,352	1,737	7,472	8,605	686	1,263	1,482	2,263	8,841	10,595	7,141	25,923	31,034
Sub-total	24,160	60,562	75,118	20,913	40,954	46,764	2,647	4,541	5,330	21,133	69,984	83,519	68,853	176,041	210,731
Upper Egypt															
Fayoum	1,238	3,170	3,932	958	2,341	2,696	133	182	214	923	2,704	3,262	3,252	8,397	10,104
Beni Suef	1,204	2,520	3,126	711	1,200	1,382	99	169	198	920	3,246	3,915	2,934	7,135	8,621
Minia	2,527	4,850	6,016	1,519	1,030	1,186	224	270	317	1,667	7,465	9,004	5,937	13,615	16,523
Assuit	2,255	5,658	7,018	2,180	3,835	4,416	151	297	349	1,080	4,775	5,760	5,666	14,565	17,543
Sohag	991	3,133	3,886	1,914	3,126	3,600	81	120	141	1,695	5,836	7,039	4,681	12,215	14,666
Qena	1,638	2,889	3,583	2,046	3,515	4,048	254	342	401	1,919	4,896	5,906	5,857	11,642	13,938
Aswan	1,127	1,798	2,230	1,231	3,011	3,468	180	284	333	1,037	2,430	2,661	3,575	7,523	8,962
Sub-total	10,980	24,018	29,791	10,559	18,058	20,796	1,122	1,664	1,953	9,241	31,352	37,547	31,902	75,092	90,087
Other															
Matrouh	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Red Sea	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Valley	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sinai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sub-total	1,848	3,669	4,550	1,949	2,606	3,002	103	244	285	2,963	6,717	7,811	6,863	13,236	15,648
GRAND TOTAL	283,832	621,888	771,358	87,379	161,366	185,438	14,825	26,029	30,549	90,833	237,891	284,492	476,824	1,047,174	1,271,837

SOURCES: Central Traffic Agency
Consultant estimate

Bus Transport - Table 2D-3 displays bus registration statistics.

Table 2D-3

NATIONAL BUS FLEET

SECTOR	FLEET 1975	FLEET 1979	FLEET 1985/86	PERCENT 1975	PERCENT 1985/86	ANNUAL GROWTH 1979-85/86
Public	5,080	6,067	9,930	53.2%	32.5%	7.9%
Private	3,415	7,076	17,480	35.8%	57.2%	14.9%
Tourist	554	974	2,036	5.8%	6.7%	12.0%
School	493	708	1,103	5.2%	3.6%	7.0%
Total	9,542	14,825	30,549	100.0%	100.0%	11.7%

SOURCE: Central Traffic Agency
Consultant Estimate

Since 1975, relative ownership shares changed significantly with the private sector accounting for 57.2 percent of the fleet by 1985/86. Registration concentrated in the major cities with Cairo, Giza and Alexandria accounting for 70.9 percent of total bus registrations. Considering only the Governorates of Fayoum, Beni Suef, Minia and Assuit, 72 percent of registered buses were public and 22.9 percent were private in 1985/86.

General Nile Company for Upper Egypt Buses - Of the four public sector bus companies providing services in Egypt, only the Upper Egypt Company provided service in the Study Corridor. It covers the area of Giza, Fayoum, Beni Suef, Minia, Assuit, New Valley, Sohag, Qena, Aswan and Red Sea. In 1984/85, its registered fleet comprised 1087 buses, as displayed in Table 2D-4.

Bus Passenger tariffs for 1985/86 are set forth in Table 2D-5. The Cairo-Alexandria and Suez-Hurgada tariffs are included for comparison with rates in the Cairo-Assuit corridor. The per kilometer rates seem to have no relation to the total distance travelled. The average rates for express and ordinary service were of the order of 10 and 6 milliemes per passenger kilometer respectively. Based on the average revenue per passenger kilometer, it appears that the greatest majority of the Company's revenue was generated by the ordinary service category.

A detailed revenue account by service class was not available. Air conditioned and luxury services operated between Governorate capitals while express and ordinary services linked the Markez level settlements. According to the Egypt National Transport Study (Reference 1), the Upper Egypt Company lagged behind the other public companies in increasing the amount of air conditioned service offered. The other companies used this service category to increase their overall profit margin.

Table 2D-4

GENERAL NILE COMPANY FOR UPPER EGYPT BUSES
(1985)

Total number of buses	1,087
Average buses operating per day	865
Service ratio	0.796
Total passenger kilometers (million)	4,250
Total kilometers per year (million)	94
Average annual kilometers per bus in service	108,670
Average revenue per passenger kilometer	6.9 milliemes
Average cost per passenger kilometer	6.7 milliemes

SOURCE: Central Traffic Agency

Table 2D-5

SAMPLE BUS PASSENGER TARIFFS (1985/86)

CITY PAIR	DISTANCE (Kms)	PASSENGER TARIFF Air Condition	Luxury	Express	Ordinary
			(milliemes /km)		
Suez-Hurgada	134	52	34		
Cairo-Alexandria	224	20			
Cairo-Fayoum	105	12	10		
Cairo-Beni Suef	123	12			
Cairo-Minia	248	12			
Cairo-Assuit	380	11			
Cairo-Sohag	479	10	8		
Cairo-Qena	622	11	10		
Unspecified	20-130			8-12	
Unspecified	5-70				4-8

SOURCE: General Nile Company for Upper Egypt Buses

Taxi Service - Referring back to Table 2D-2, the taxi fleet experienced its greatest annual rate of increase, 22.2 percent, during the period 1970-75. The rate for 1984-1985/86 was a more moderate 9.8 percent per year. Three categories of service were provided: inter-city taxi, service taxi and meter taxi.

The inter-city taxi operated, in general, between Governorate and Markez capitals. The "Union of Inland Transport of Passengers" negotiated official rates and operating procedures. It also maintains the taxi terminals on behalf of the members. The Peugeot 504 type was the predominant vehicle within the fleet but in 1985/86 an increasing number of micro and minibuses with 11,15 or 20 seats were expanding the fleet passenger capacity, and providing a lower cost per seat compared to the Peugeot 504.

During the six to seven years prior to this Study, increasing numbers of service taxis appeared to supplement public bus service in and between the rural villages. While the predominant type was a small pickup with a canvas or wooden structure and benches placed in the truck bed, a minor number of micro and minibuses were included in the service taxi category.

Meter taxis were located primarily within the larger urban areas. These were a mixture of small passenger type vehicles which occasionally, provided intercity service.

The official tariffs for each category are delineated in Table 2D-6.

Table 2D-6

TAXI PASSENGER TARIFF
(1985/86)

CATEGORY	TARIFF
Inter-City	13 milliemes per passenger km.
Service	10 milliemes per passenger km.
Meter (mainly urban)	330 fixed, per vehicle, plus 100 milliemes per km after the first

SOURCE: Central Traffic Agency

An estimated 5.2 percent of the taxi fleet was registered in the Governorates of Fayoum, Beni Suef, Minia and Assuit in 1985/86, compared to 5.6 percent during 1979.

Freight Transport

Road freight transport was provided by five public trucking companies, private sector cooperative trucking associations, "own account" private non-transport oriented enterprises , non-organized individual trucks, and trucking companies based on Law 43. Law 43 grants tax privileges and duty exemptions to companies contributing to special development projects.

Table 2D-7 shows the growth of the truck fleet from 1975.

Table 2D-7

TOTAL TRUCK FLEET

TRUCK SIZE	YEAR 1975	1981	1985/86	ANNUAL GROWTH RATE 1975-1985/86	1981-1985/86
Pick up <3 ton	9986	80178	170695	30.9%	18.2%
3-5 ton	8492	14575	28449	12.2%	16.0%
5-10 ton	14378	37938	71123	16.4%	14.9%
> 10 ton	3920	8185	14225	13.0%	13.0%
Total	36776	140876	284492	21.5%	16.8%

SOURCE: CAPMAS
Consultant estimates.

The increase in the total truck fleet was quite vigorous averaging 21.5 percent per year in the period 1975-1985/86. The pick-up category accounted for a major portion of this increase, averaging 30.9 percent for the decade and 41.5 percent annually for the period 1975-1981. Incomplete statistics for the year 1985/86, provided by the Central Traffic Agency, indicated the rate of increase was much less for the period 1981-1985/86, averaging 16.8 percent annually for the total fleet.

An estimated 14 percent of the fleet was owned by the public sector (five public transport companies and "own account" public enterprises). Private sector cooperatives accounted for 36 percent, with the remaining 50 percent distributed among individuals, small transport firms and "own account" private enterprises.

Public Freight Transport Companies - The five Public Freight Companies were:

- General Nile Company for Inland Transport
- General Nile Company for Goods Transport
- General Nile Company for Transport Works
- General Nile Company for Direct Transport
- General Nile Company for Heavy Transport

These companies received government support. In general, they transported essential imported commodities from the ports to the Governorate distribution centers, and products for export from the manufacturing sites to the ports.

The companies also allocated work to the cooperatives for transport of significant tonnages of cargo nominally designated for public transport. Amounts assigned to cooperatives were as follows:

1979	3.4 million tons
1982/83	4.5
1984/85	3.5

Performance of the five companies appears in Table 2D-8.

Table 2D-8

PERFORMANCE OF FIVE PUBLIC TRUCKING COMPANIES

	YEAR		
	1979	1982	1984/85
Transport Volumes (million tons)	5.0	6.8	10.5
Ton/Km (million)	1456	1946	2527
Total Distance Covered (million km)	86.3	97.0	111.0
Total Loaded Distance (million km)	64.3	73.0	86.2
Fleet (number of trucks)	1732	1971	1970
Daily Average Vehicles in Service	1227	1407	1485
Service Factor	0.71	0.71	0.75
Average Length of Haul (km)	290	290	240
Average Load Per Shipment (tons)	22.6	27.0	29.3
Annual Total Distance Per Vehicle In Service(km)	70330	68970	74806

SOURCE: Annual Financial Reports of Companies.

From 1979 to 1984/85, the vehicle fleet increased by 2.4 percent per year while the transport volume increased by an average of 14.4 percent per year, from 5 million tons to 10.5 million tons. This increase in tonnage reflected improved vehicle utilization (.71 to .75 service factor), increased average load (22.6 tons to 29.3 tons) and a shorter average haul distance (290 km. to 240 km). The average annual total distance per vehicle in service also increased from 70,330 kilometers to 74,806 kilometers.

Other Public Companies (Own Account) - No official information was available on truck fleet sizes belonging to public non-transport oriented enterprises. While the public sector (public transport companies plus "own account") share of the total truck fleet was decreasing, it was estimated to comprise 14 percent of the total fleet in 1985/86. Vehicle types ranged from pickups to heavy specialized vehicles. Vehicle

registration data, while incomplete, indicated a continuing tendency towards self sufficiency in transport on the part of public enterprises.

Cooperative Trucking Companies - The cooperative truck fleet increased at an annual average rate of 27.4 percent during the decade 1975-1985. Vehicles belonging to members comprised about 36 percent of the total truck fleet in 1985. The Union of Cooperatives in Cairo coordinated cooperative participation in the large public trucking contracts allocated through the five public transport companies. Members were provided credit facilities and reduced prices for spare parts, tires, and use of maintenance facilities.

Details of the total Cooperative 1985 Vehicle Fleet are set forth in Table 2D-9.

Table 2D-9

TRUCK FLEET
COOPERATIVE ASSOCIATION 1985

TYPE OF TRUCK	FLEET
Pick-up	44269
Single truck (3-10 T)	14041
Single truck(> 10 T)	32263
Truck combination(20 T)	3858
Articulated truck(30-40T)	6967
Total	101398
Total less Pick up	57,129

SOURCE: Union of Cooperatives

The pick-up category constituted about 44 percent of the fleet while heavy truck and truck combinations (>10 tons) comprised 42.5 percent.

Other Private Sector Trucking - While at least two private sector transport companies (Ismalia Transport Company and Egyptian American Transport Company) operated under Law 43, their fleets were relatively small. The great majority of other private sector road transport comprised individual truckers, small firms and "Own Account" transport by non-transport oriented enterprises. No official data was available on this portion of the vehicle fleet.

Road Freight Transport Tariffs

At the time of this Study, Highway freight transport was not regulated, and there were no restrictions as to entry routing or vehicle specifications. Axle load limits of 10 tons for single and 16 tons for tandem axles were not enforced. With the exception of shipments

contracted through the five public transport Companies, rates were essentially determined by competition.

The five public transport companies worked with negotiated contracts with a number of ministries for transport of basic supply commodities, fertilizer and cooperative marketing products. Sub-contracts with cooperatives for transport of a portion of this cargo served the function of price leader for the private sector.

Table 2D-10 and Figure 2D-1 depict average per ton-kilometer rates for selected commodoties transported by the cooperatives in 1985.

Table 2D-10

GOODS TRANSPORT CARGO TARIFF FOR COOPERATIVES
(1985/86)

CITY PAIR	DISTANCE (kms)	FREIGHT RATE (milliemes per ton-kilometer)					
		Timber	Petroleum	Wheat	Metals	Fertilizer	Cement
Cairo-Fayoum	105	57	60	56	57	56	57
Cairo-Beni Suef	123	57	60	48	49	48	49
Suez-Cairo	140		60	46	43	42	43
Port Said-Cairo	224	67	40	36	29	36	33
Alexandria-Cairo	224	67	40	36	29	36	33
Cairo-Minia	248	56	40	35	29	26	28
Cairo-Assuit	380	53	35	25	28	26	28
Cairo-Sohag	479	56	35	32	28	26	28
Alexandria-Assuit	604	56	30	31	29	22	28
Cairo-Qena	622	56	30	31	29	22	28
Cairo-Aswan	904	55	30	30	29	22	28

SOURCE: Union of Cooperatives

Rates appeared to decrease rapidly as a function of distance in the 100 to 250 kilometer range. Long distance (> 300 kilometer) rates were more constant with a modest taper averaging about 32.5 milliemes per ton-kilometer.

As an indication based on discussions, Figure 2D-1 also shows tariff levels applying in the free-market.

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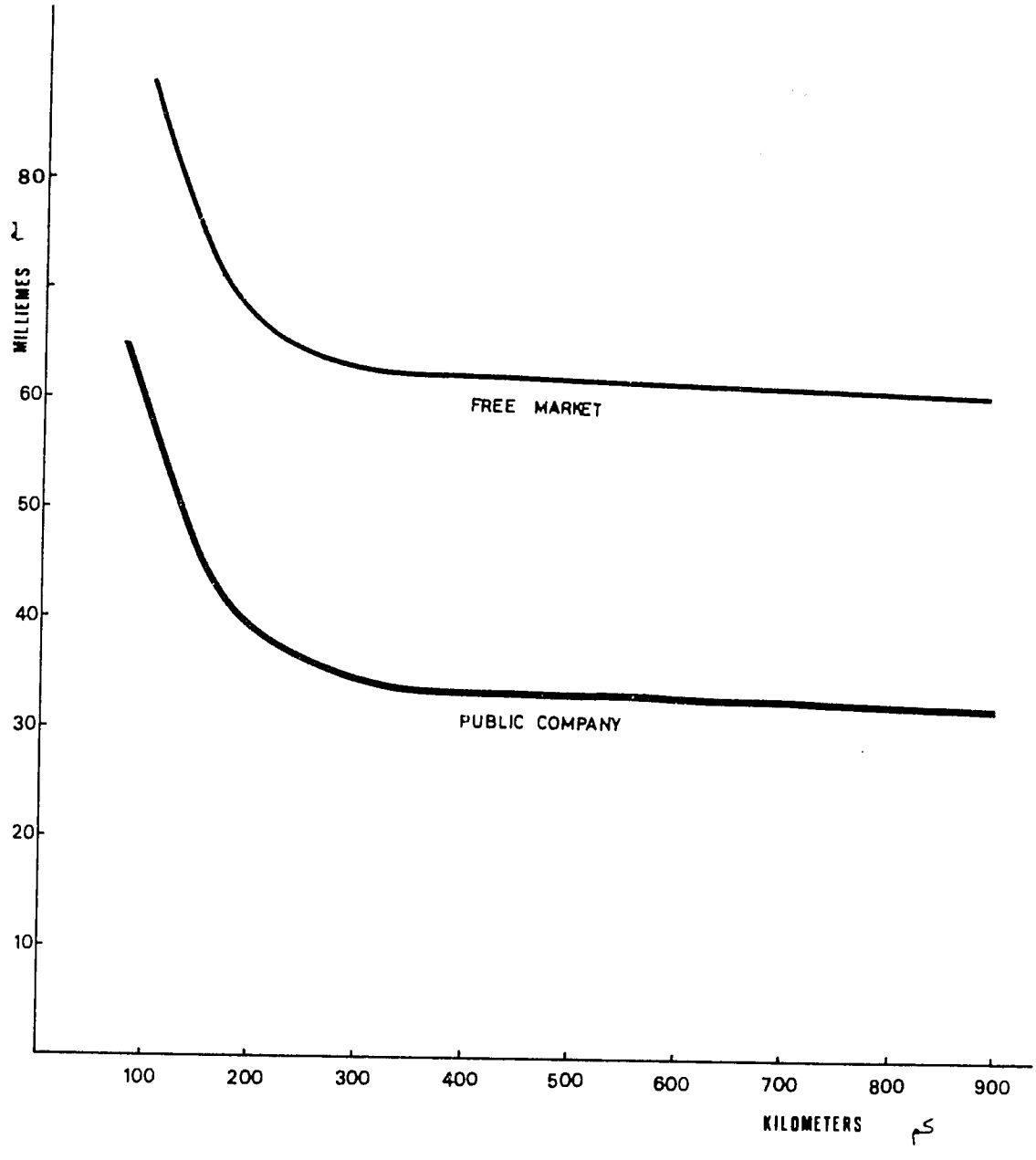

Cairo – Assutit Highway Feasibility Study

AVERAGE TRUCK FREIGHT TARIFFS

(MILLIEMES PER TON KM., 1985/86)

Wilbur Smith and Associates
Egyptian Consultants Consortium

Figure 2D – 1

Appendix 2E

NON-HIGHWAY TRANSPORT MODES

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Appendix 2E

NON-HIGHWAY TRANSPORT MODES

The focus of this Study was clearly on highway transport and the road investment needs that it generates. However, users of transport services are not confined to highways and developments in other modes of transport can have a significant impact on future traffic volumes. Therefore it was necessary to examine the trends in transport by other modes and to account for them in making forecasts of highway traffic. In particular, it was necessary to identify any investments or developments in other modes which could significantly impact highway traffic volumes. The converse -- the impact that highway investments might have on other modes -- was dealt with in the evaluation phase of the Study.

The Study reviewed the condition and plans of the three major modes competing with highways; railroads, water and pipeline. The main source of published information was the Egypt National Transport Study (ENTS) Phase III (Reference 1) which reported in June 1984, but visits were also made to the three modal authorities concerned to update the published data. Special emphasis was put on the assessment of the railroads, and a railroad expert from the Consultant visited the Study for one month for this purpose.

Qualification of the ENTS Report - In considering the ENTS appraisal of the future position of each of the modes, it is important to note that the objectives of ENTS were quite different from those of this Study. ENTS stated that their forecasts were of a "target-setting" nature and were not a forecast of what would actually happen. In particular, their forecasts reflected a transport pricing policy which would transfer transport from roads to other modes. They frankly admitted that their forecasts represented a "tremendous challenge to put in front of the railways and inland waterways sector" and stated that some of their forecasts for these modes were "hard to imagine at this moment".

While it is proper for a national transport study such as ENTS to set policies and targets for all modes of transport, that was not the business of this Study. For planning road investment needs, a realistic appraisal is required of what is actually likely to happen. The impact on highway feasibility of major shifts to other modes can then be explored in sensitivity tests. Therefore, although the ENTS Study was an extremely valuable reference source, the ENTS transport forecasts had to be treated with considerable caution.

Railroad Operations

This review was based on a one-month analysis of Egyptian railroad operations in the Cairo-Assuit corridor made by the railroad specialist of the Consultants. Some data on current operations were also provided by the Egyptian National Railway Authority (ENRA).

General - The segment of the ENRA network between Cairo and Assuit is a double-track standard gauge rail line comprising a route length of 375 kms.

The rail line is located west of the Nile River and follows parallel a major north-south irrigation canal (the Tur et el Giza from Cairo to Beni Suef, then the Ibrahimiya to Assuit). The Cairo-Assuit Highway is also adjacent to the canal but at most locations is located on the opposite bank from the railroad. The topography of this corridor is flat and the rail line is generally level and relatively straight with no apparent problems due to gradient or curves.

Track Description - Data gathered on a field trip indicated that the track was constructed generally of 53 kg and 54 kg rail manufactured between 1960 and 1985, with some older 47 kg rail with dates of manufacture noted between 1912 and 1932. Much of the track was of continuous welded rail (CWR) on concrete sleepers and timber sleepers. Some steel sleepers were in use at scattered locations throughout the southern portion of the line.

Rail was laid in track panels of 18 meter lengths. These were thermit welded to longer lengths of 180 to 200 meters or longer to form continuous welded rail (long rail) sections. Switches (turnouts) were also pre-fabricated in panels; this permits rapid installation with the least disruption to traffic.

The condition of the track varied throughout the 375 kms. Although it appeared that some extensive upgrading or track renewal work had been in progress on this line in recent years and in fact was still in progress at the time of this Study, much remained to be completed. Many switches (turnouts) and crossovers needed replacing and a significant amount of track and road work was required at the numerous level crossings. Where the track had been reworked or rails replaced, much of the released material remained along the shoulder of the embankment. At many locations the scrap track material had been, or was being, covered by ballast that had been cleaned or undercut from the track.

Observations along the track also indicated that some portions of the track upgraded in recent years had not been adequately maintained and some defects had begun to develop at rail ends. Broken rail within the joint area and chipped or battered rail ends were noted at several locations both in the newer as well as the older rail sections.

Trips by rail indicated that the riding quality of trains was variable. Discussions with passengers confirmed that there had been an improvement in the riding quality over the last 2 or 3 years. This could be attributed to the upgrading of the track as well as to new equipment. Even though the riding quality of some segments was still poor at the of review, it did appear that the track improvement program was showing results.

Train Speeds - The ENTS Phase II Report gave the permissible train speed as 90 kms per hour between Cairo (Km 0.0) and Wasta (Km 92), and 110 kms per hour between Wasta (Km 92) and Assuit (Km 375). Information obtained from a representative of ENRA indicated the maximum speed between Cairo and Assuit to be 100 kms per hour for passenger trains and

60 kms per hour for freight trains.

Average running speeds were said to be 90, 90 and 50 kilometers per hour for express passenger, ordinary passenger and freight trains respectively. However, it was noted that the timetable indicated between five and five-and-a-half hours between Assuit and Cairo, which implied an average of only 70 kilometers an hour, and that delays of an hour or more were very common in the Greater Cairo area further reducing the average running speed to less than 60 kilometers per hour.

Signal System - A review of ENTS also indicated that train operations between Cairo and a point 20 kms south of Cairo in the vicinity of Giza, were controlled by centralized traffic control (CTC). The CTC system provides for operation of all signals and switches by remote control from one central location.

The majority of the rail line was equipped with a mechanical signalling system. With the mechanical system, all points (switches), crossings and signals are operated from signal cabins by means of a series of pipe rods, cables or wires, and pulleys. From observations along the corridor, it was apparent that the mechanical signal system was in need of considerable maintenance. Many of the pulleys were missing and the wires or cables lay on the ground. The released scrap track material along the embankment, as well as the old ballast cleaned from the track, blocked the wires and prevented the proper functioning of the signal devices.

Both the ENTS Phase II and Phase III reports stated that contracts to change the signal system between Giza and Assuit to CTC had been awarded. Field observation of this line suggested that this work has not been accomplished by the time of this Study. ENRA advised that work on CTC would be completed within 3 years between Giza and Beni Suef.

The ENTS reports also indicated that work was in progress on the installation of automatic train control (ATC) between Giza and Assuit and ENRA advised that this work had been completed. With the ATC system, speed adherance is theoretically assured when a train passes a yellow signal and a train is stopped when attemping to pass a red signal.

Line Capacity - The ENTS Phase II calculated the 16 hour capacity of the various segments of the Cairo to Assuit rail line. Most of the trains operating in Egypt are passenger trains and operate during the day, therefore 16 hours were considered for actual capacity. The remaining 8 hours per days were to allow ample time for freight trains, night express trains and for maintenance. Table 2E-1 provides a breakdown of the calculated capacities.

Table 2E-1 also shows the average number of passenger trains and the estimated number of freight trains operating in 1983. According to the ENTS Report the freight trains did not follow a pre-set schedule so a daily allowance for a given number of train paths or time slots was provided.

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Table 2E-1

CAIRO-ASSUIT RAILROAD LINE
SECTION CAPACITIES AND OPERATIONS
(Trains Per Day)

LINE SECTION	16 HOUR CAPACITY(1)	1983 PASSENGER TRAINS(1)	1983 FREIGHT TRAINS(3)	1986 PASSENGER TRAINS(2)	1986 FREIGHT TRAINS(3)
Imbaba-Giza	123	61	20	58	20
Giza-Marazik	123	61	20	58	20
Marazik-Mazghouna	101	61	20	58	20
Mazghouna-El Wasta	101	61	20	56	20
El Wasta-Beni Suef	78	54	20	49	20
Beni Suef-Maghagha	78	51	16	46	16
Maghagha-Minia	78	51	16	47	16
Minia-Dairut	69	51	16	46	16
Dairut-Assuit	69	51	16	48	16

(1) ENTS Phase II
(2) Egyptian Railway Timetable, July 1985
(3) Estimated from observations; see text

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Additional columns in Table 2E-1 show the number of passenger trains operating in 1986 based on the current Egyptian Railway Timetable and a daily allowance for freight trains as a result of data gathered on a field trip. The timetable data for 1986 indicated rather fewer trains in 1986 than operated in 1983. Field observations of freight trains indicated an average of 20 freight trains operated per day between Cairo and Minia and 16 freight trains operated between Minia and Assuit. These numbers were used for the estimated numbers of freight trains operating between Cairo and Assuit in both 1983 and 1986, even though a greater number of train-paths or time-slots were provided in the ENTS analyses.

Rolling Stock - A review of the ENTS Phase II and Phase III Reports showed there was a significant increase in the passenger equipment inventory between 1979 and 1983. Not only did the numbers of cars increase but some of the oldest cars were withdrawn from the fleet improving the age and quality of the fleet. However, from observations, the passenger equipment operating in the corridor appeared to be heavily used with little servicing being performed other than interior cleaning.

While the number of freight cars increased only slightly between 1979 and 1983, a significant number of new cars were added to the fleet and many older cars retired. ENTS recommended improvements in operating procedures to improve equipment utilization and to expand the equipment maintenance facilities, rather than to continue the purchase of additional freight equipment.

One ENTS recommendation for improved equipment utilization was the elimination of the operational restriction limiting freight traffic to night hours (12:00 midnight to 6:00). The restriction was clearly not in effect in the Cairo-Assuit corridor at the time of this Study since as many as 10 freight trains were observed operating between 8:00 am and 6:00 pm on successive days.

Passenger Train Lengths - Observations indicated that ENRA adopted the recommendations relating to the average length of passenger trains proposed in the ENTS and were running longer trains than in 1979. In fact some observations in the Study corridor suggested that train lengths were longer than those in 1983 and were more in keeping with the year 2000 averages. Increased train length more than offsets the apparent reduction in the number of passenger trains since 1983 indicated in Table 2E-1. Observations indicated that many of these trains were operating near capacity.

Future Track Capacity - ENTS projections of traffic, based on their "target setting" policy for railroads, indicated that the 16-hour track capacity (as used for their base year analyses) would be exceeded by the year 2000 in the Cairo-Assuit Corridor. On the basis that track improvement and the introduction of CTC through power signalling would improve rail operating efficiency, ENTS considered that 24-hour capacities would be appropriate for assessing future traffic on the Upper Egypt line. 24 Hour capacities and ENTS forecast train volumes are set out in Table 2E-2.

Table 2E-2

CAIRO-ASSUIT RAILROAD LINE
ENTS SECTION CAPACITIES AND PROJECTED OPERATIONS
(trains per day)

Line Section	ENTS 2000			
	24 Hour Capacity	Passenger Trains	Freight Trains	Total
Imbaba-Marazik	184	88	14	102
Marazik-El Wasta	151	88	14	102
El Wasta-Beni Suef	117	81	12	93
Beni Suef-Minia	117	78	10	88
Minia-Assuit	103	77	10	87

SOURCE: Egyptian National Transport Study Phase III, 1984.

At the time of this Report, it was expected that the installation of CTC planned between Giza and Beni Suef would be completed by the end of 1989. This would increase line capacity and would be an important step for more efficient operations and in providing "free track" time for track maintenance. However, there appeared to be no definite plans for the extension of CTC from Beni Suef to Assuit, as assumed by ENTS. Also, based on detailed observations of train and track operations, it can be commented that greater emphasis must be placed on training, improving operating efficiency, and improving maintenance methods and procedures, in order to meet the necessary track maintenance standards and train capacity envisaged by ENTS.

ENTS Forecast Train Operations - ENTS projected passenger volumes to increase by approximately 33% between 1987 and 2000, with the number of passenger trains increasing by 50 to 65 percent. The envisaged greater increase in the number of trains over increase in passengers would help relieve the crowded trains and would make travel by train more attractive.

The average number of freight trains estimated by ENTS to be operated per day in the year 2000 (Table 2E-1) reflects a reduction in the number of freight trains. Rail freight volumes for the corridor were expected to increase however. This increase in volume with fewer trains was to be achieved in part by the operation of heavier net car loads.

With the exception of the addition of the 88 freight cars for alumina in 1987 and the replacement of 95 wheat hoppers in 1999 and 2000, ENTS concluded that the freight cars had increased to a number which could cope with the forecast demand, provided operations were improved to reach a higher level of efficiency. The development of a higher level of efficiency was said to be the key to the future ability to handle this traffic.

Study Estimates of Potential Rail Traffic Growth - Observations of train lengths in early 1986 showed an average of 28 cars per train. Using an average net load of 30 tons per car, 28 cars per train, and 6 trains per day (which allows for an average of 6 trains per day for empty back haul), and assuming trains operating 365 days per year, a potential traffic volume of 1.8 million tons per year was estimated. An increase in train length could boost this figure to the 2.4 million tons per year forecast by the Railroad Authority by 1990, although it was concluded that such a target tonnage was unlikely to be achieved by that date.

The annual volumes indicated above were considered to be achievable by the Egyptian National Railway Authority but were below even the low projection of ENTS. Considering the number of passenger trains in the corridor that would likely be given priority over most freight trains, to achieve the ENTS forecast freight volumes would require considerable improvements in operational and maintenance procedures observed today.

Conclusions on Railroad Operations - While improvements in train operations had clearly been made since 1983, the Study was not convinced that the ENTS forecasts of track capacity and rail traffic could be met. The investments in centralized traffic control (CTC) south of Beni Suef envisaged by ENTS did not appear to be committed, and standards of track

maintenance fell short of that required for substantial increases in train operations. It was concluded that ENRA should be able to keep up with the normal growth in traffic associated with general growth in economic activities, but available evidence did not point to major growth in rail traffic sufficient to take traffic away from other modes.

River Transport

A visit was made to the River Transport Authority to discuss the current situation and future prospects for river transport between Cairo and Assuit. It was stated that there had been no significant changes over the past few years and that the description of the ENTS study were still applicable.

The most recent statistics from ENTS related to 1982/83. These indicated that the Nile between Cairo and Assuit was the most heavily trafficked section of the Egyptian waterway system carrying nearly 3 million tons, or 70 percent, of the total tonnage of 4.2 million tons per year on the complete Egyptian waterway system. Just under half this traffic was destined for places within the Cairo-Assuit corridor with the rest passing between the rest of Upper Egypt and the North.

The commodities carried were as follows:

Petroleum Products	1.21 million tons
Construction Materials	0.85
Minerals	1.41
Agricultural Products	0.15
Industrial Products	0.38
TOTAL	4.21 million tons

Most of these products were moving within the Cairo-Assuit corridor, with the exception of about 0.8 million tons of mineral products and all the agricultural products.

Future Waterway Operations - ENTS forecast a 75 percent increase in traffic in the period from 1983 to 1987, principally in minerals and construction materials, both commodities ideally suited to river transport. However, discussions with the River Transport Authority indicated that the planned increase had not taken place.

It was noted by the River Transport Authority that a particular problem for river transport was that the Nile and all other navigable waterways in Egypt were controlled by the Ministry of Irrigation, as land irrigation was considered to be the principal role of the river system. Since the Ministry of Irrigation determines all investments connected with the maintenance of the waterways, the River Transport Authority has little influence in setting priorities.

It was claimed that improvements by means of dredging would significantly improve the service which could be offered by river

transport, but it was felt that the necessary investments in dredging did not have a high priority. To some extent, this statement was backed up by the Egyptian General Petroleum Corporation who said that they preferred to move their long distance supplies of petroleum products to depots in the Upper Egypt Governorates by river, but that it was necessary to make extensive use of rail and even road to cover periods in the year when the Nile was too low for navigation.

Some investments were being made by others, notably for the new cement plant at Assuit where facilities for transport of cement by river were being constructed, but the usefulness of these facilities could be compromised by lack of investment elsewhere in the waterway system.

Pipeline Transport

At the time of this Study, there was no pipeline in operation in the corridor, but a petroleum product pipeline between Cairo and the new oil refinery in Assuit was under construction, to open in 1987. Both the pipeline and the new refinery were expected to be in full operation by 1990, the first forecast year of this Study. The pipeline was expected to carry all future inter-Governorate movements of light petroleum products (diesel and gasoline).

At the time of this Study, petroleum products were distributed from Tabin to supply centers in each of the Governorate Capitals. It was stated that water transport was the preferred means of transport, but that rail was used when water levels were too low for river navigation. Road transport had the lowest priority for this long distance transport because of cost. However, road fleets based in each of the Governorates were used for local distribution of products.

According to ENTS, total movements of petroleum products in the corridor in 1983 were about 2.2 million tons. Since 1.2 million tons moved by water transport, this indicates 1.0 million was split between rail and road, mostly to rail.

Hence the main impact of the new pipeline would be on the operations of the railroad and the waterways. However, there were some movements of petroleum products by road which would be eliminated by the pipeline and this was taken into account in the forecasts of road traffic. Distribution of petroleum products to local destinations within the Governorates was assumed to continue to be undertaken by road.

Modal Traffic Forecasts

No attempt was made by this Study to prepare detailed forecasts of traffic on the non-highway modes of transport. It was considered that the Study did not have the resources, and would not achieve sufficient cooperation from the modal authorities, to permit an improvement on the analyses undertaken in the ENTS Study, which was specifically concerned with all modes of transport.

Instead, a critical review was made of the forecasts made by ENTS to determine the reasonableness of the forecasts in the Cairo-Assuit corridor. Particular attention was paid to the "target-setting" nature of the ENTS forecasts, and allowances made as appropriate for the needs of this Study.

ENTS made forecasts for all modes of transport including, of course, the highway sector. The ENTS highway forecasts are included in this review for the sake of comparison with other modes. Partly because of the "target-setting" approach of ENTS, which tended to favor the non-highway modes, the highway forecasts of this Study differed significantly from those of ENTS.

ENTS took 1983 as a base year, although in many cases, the figures for 1983 represented an updating with limited data of more detailed survey results from 1979. Detailed analysis of the survey results of this Study provided an update on the ENTS results for highways. The survey results are included in this review. Some recent data were available on rail transport and these also are compared to the ENTS results.

ENTS made three sets of forecasts, one for 1987 and two, a low and a high, for the year 2000. For the 2000 High (2000H) forecast, ENTS assumed an overall growth in Gross Domestic Product (GDP) of 8 percent per year from 1983 to 2000. The 2000 Low (2000L) forecast assumed that GDP growth would slow to 5 percent per year from 1987 to 2000.

The ENTS data reviewed by this Study were extracted from the detailed matrices of movements for all of Egypt presented in the Phase III Final Report (June 1984). For the purposes of this comparison, it was assumed that 20 percent of Giza Governorate and 75 percent of Assuit Governorate lay within the Study corridor, together with the entire Governorates of Fayoum, Beni Suef and Minia.

The modal forecasts are discussed separately for freight and for passengers.

Forecasts of Freight Movements by Mode

Table 2E-3 presents the ENTS forecasts of inter-governorate freight movements by mode in the Cairo-Assuit Corridor, and compares them with data on current movements from this Study and the Egyptian National Railway Authority (ENRA).

Road Freight - As estimated by ENTS, inter-governorate freight movements carried by road dominated those carried by by the other three modes.

The estimates by this Study of inter-Governorate road freight moving in the corridor (derived from the Roadside Interview Survey in Dec 85/Jan 86) lay between the ENTS estimates for 1983 and 1987. Through movements recorded in this Study were below even the ENTS 1983 estimates, which indicates an overestimate on the part of ENTS. For movements with an origin or a destination in the corridor, however, this Study recorded a greater volume by road than the ENTS 83/87 figures. It was concluded that

Table 2E-3

INTER-GOVERNORATE FREIGHT MOVEMENTS IN THE CAIRO-ASSUIT CORRIDOR
(millions of tons per year)

DATA	YEAR	INTERNAL CORRIDOR	TO CORR FROM: Upper Egypt	TO CORR FROM: Lower Egypt	FROM CORR TO: Upper Egypt	FROM CORR TO: Lower Egypt	TOTAL MOVEMENTS WITH O/D IN CORR	CORRIDOR THROUGH MOVEMENTS: South to North	CORRIDOR THROUGH MOVEMENTS: North to South	CORRIDOR THROUGH MOVEMENTS: Total Throughs	TOTAL CORRIDOR	TOTAL EGYPT
Road Freight												
CAS	85	2.32	0.49	7.25	1.51	4.45	16.02	0.91	2.03	2.93	18.95	
ENTS	83	1.83	1.04	6.24	1.22	3.50	13.82	1.51	3.19	4.71	18.53	119.94
ENTS	87	2.42	1.05	6.89	1.98	4.90	17.23	1.79	3.43	5.23	22.45	154.52
ENTS	20L	4.23	2.02	11.54	2.91	7.33	28.04	3.30	5.46	8.76	36.79	278.05
ENTS	20H	6.14	3.03	15.61	4.15	9.97	38.91	4.60	7.28	11.88	50.79	393.12
Rail Freight												
RR	85										1.70	
RR	86										1.90	
RR	90										2.40	
ENTS	83	0.00	0.14	0.41	0.02	0.52	1.10	0.62	0.75	1.37	2.46	6.77
ENTS	87	0.00	0.12	0.66	0.19	0.51	1.47	0.28	0.22	0.50	1.98	7.13
ENTS	20L	0.08	0.43	0.77	0.56	0.51	2.34	0.20	0.28	0.48	2.82	14.12
ENTS	20H	0.23	0.56	1.07	1.43	0.51	3.79	0.29	0.39	0.68	4.46	19.29
Water Freight												
ENTS	83	0.00	0.16	0.72	0.00	0.50	1.38	0.78	0.82	1.60	2.98	4.21
ENTS	87	0.00	0.25	0.73	0.00	0.60	1.58	1.27	1.04	2.30	3.88	6.08
ENTS	20L	0.15	0.34	0.40	1.16	0.70	2.76	1.74	0.21	1.95	4.71	8.42
ENTS	20H	0.18	0.38	0.59	1.52	0.77	3.43	2.17	0.26	2.43	5.86	10.63
Pipeline Freight												
ENTS	83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.23
ENTS	87	0.00	0.00	1.18	0.00	0.00	1.18	0.00	0.23	0.23	1.41	10.05
ENTS	20L	0.51	0.17	3.72	0.76	0.00	5.16	0.00	1.24	1.24	6.40	31.40
ENTS	20H	0.73	0.24	5.39	1.10	0.00	7.46	0.00	1.80	1.80	9.25	44.42

Sources: ENTS -- Egypt National Transport Study Phase III, 1984
RR -- Egyptian National Railway Authority
CAS -- Study surveys

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road freight had grown quite strongly, despite an economic growth rate slower than envisaged by ENTS, and that a transfer of freight to other modes had not made any significant impact.

Not too much weight should be put on a comparison of detailed survey results from this Study with partial ENTS matrices, which were really concerned with growth in Egypt as a whole. In fact, it can be concluded that the two studies show remarkable agreement on existing road freight movements in the corridor.

Rail Freight - ENTS data showed a low volume of existing freight movement by rail. Most was shown as passing through the corridor, and none was indicated between locations entirely within the corridor. The most optimistic forecast for the year 2000 showed a doubling of traffic including through movements, and a quadrupling of movements considering only those serving origins and destinations within the corridor.

Estimates of freight movements from ENRA indicated significantly lower rail volumes than the ENTS data. This may merely reflect limitations with the statistics provided, rather than a true picture of the situation, but observations by the rail specialist to the Study indicated that growth had been, and would likely continue to be, lower than forecast by ENTS. As noted above, the forecasts of rail traffic by ENTS were optimistic targets for the railways to aim at, rather than realistic assessments of what would actually happen.

Waterways - ENTS indicated relatively low volumes of existing waterway traffic, divided almost equally between through movements (between Cairo and Upper Egypt south of Assuit) and movements serving destinations in the corridor. As part of the "target setting" procedure of ENTS, a strong growth in waterway traffic was forecast, with similar results as for rail traffic: in this case, a doubling of all traffic including through movements, and a tripling of movements with an origin or destination in the corridor, by the year 2000.

No more recent data were available on freight movements by waterway. However, as indicated above, the shift towards water transport envisaged by ENTS did not appear to have started, although investments in cement handling facilities in Assuit were being made. The River Transport Authority were not optimistic about future growth prospects without a change in investment priorities on the part of the Ministry of Irrigation.

Pipelines - There was no reason to doubt the ENTS pipeline forecasts, and it did not really matter to this Study if they were high or low. The main point was that all inter-Governorate movements of light petroleum products would in future take place by pipeline, because it would be the the most economical mode of transport for these goods and would be fully under the control of the petroleum distribution authorities. With the completion of the new pipeline to Assuit, there would be no good reason to use other modes, except in case of emergencies.

Conclusions on Future Freight Transport - With the exception of the construction of the Cairo-Assuit pipeline, which was expected to carry all

future movements of light petroleum products in the corridor, a conservative estimate for the purposes of this Study had to be that growth in road freight transport would be largely unaffected by developments in other modes of transport. Hence the initial forecasts of road freight for this Study assumed that there would be no major switch to rail or waterways in the future. In the evaluation phase, sensitivity tests were used to explore the effect of lower growth rates in road traffic which could be attributable, at least in part, to higher growth in other modes.

Forecasts of Passenger Movements by Mode

The ENTS forecasts of inter-Governorate passenger traffic for the corridor are set out in Table 2E-4. They are compared with estimates for road and rail transport taken from the surveys undertaken by this Study and from statistics supplied by ENRA. As with the freight forecasts, the ENTS passenger forecasts by road transport are included for the sake of comparison; the specific road transport forecasts for this Study are described in Appendix 6C to this Report.

General - ENTS estimated that passenger traffic in the corridor in 1983 was divided roughly into thirds between rail, bus and taxi transport, each with about 20 million passengers per year counting trips with an origin or destination in the corridor. Each mode carried some through traffic, but this was significant only for rail at about 5 million passengers per year. A small proportion of corridor traffic was taken by private car at just under 5 million passengers per year, most of them with origin or destination in the corridor.

A significant difference between ENTS and later statistics was in the proportion of traffic with both origin and destination in the corridor; the later statistics indicated a much higher proportion of such movements for rail and a much lower proportion for bus and taxi passengers.

ENTS expected growth in bus and rail passengers to keep pace with each other, growing at between 2 and 3 percent per year, with only a slightly higher growth for bus passengers. Taxi and car passengers were expected to increase much more rapidly.

Rail Passengers - Rail passenger figures supplied by ENRA indicated only 16 million passengers per year in the corridor compared with about 26 million estimated by ENTS for rail in 1983. It is possible that ENTS included military movements which showed in the ENRA estimates for 1986 supplied to the Study, but which were excluded from Table 2E-4. ENRA forecast 25 million passengers per year for 1990, which was near the ENTS 1987 estimate. However, this rapid increase must be viewed as somewhat optimistic in the light of the assessment of the railroad specialist presented earlier in this Appendix.

Bus, Taxi and Car Passengers - The estimates of bus and taxi passengers made from the the Roadside Interview Survey agreed quite well with the ENTS estimates. Note that ENTS included microbuses with taxis, whereas this Study included them with standard buses; allowing for this, the agreement between ENTS and this Study is even more striking.

Table 2E-4

INTER-GOVERNORATE PASSENGER MOVEMENTS IN THE CAIRO-ASSUIT CORRIDOR
(millions per year)

DATA	YEAR	VEHICLE	INTERNAL CORRIDOR	TO CORR FROM: Upper Egypt	TO CORR FROM: Lower Egypt	FROM CORR TO: Upper Egypt	FROM CORR TO: Lower Egypt	TOTAL MOVEMENTS WITH O/D IN CORR	CORRIDOR THROUGH MOVEMENTS: South to North	CORRIDOR THROUGH MOVEMENTS: North to South	CORRIDOR THROUGH MOVEMENTS: Total Throughs	TOTAL CORRIDOR	TOTAL EGYPT
Rail Passengers													
RR	86		6.46	1.09	2.98	1.09	3.10	14.71	0.68	0.68	1.35	16.06	
RR	90		9.11	2.00	5.63	2.00	3.78	22.52	1.40	1.40	2.80	25.32	
ENTS	83		3.63	1.98	6.55	1.96	6.58	20.68	2.62	2.61	5.22	25.92	215.51
ENTS	87		4.03	2.12	7.31	2.15	7.28	22.89	2.28	2.25	4.53	27.42	250.73
ENTS	20L		4.78	2.75	10.03	2.75	10.05	30.36	2.8[illegible]	2.87	5.72	36.08	308.41
Bus Passengers													
CAS	85/86	Microbus	0.26	0.00	0.88	1.20	1.08	3.41	0.01	0.01	0.02	3.43	
CAS	85/86	Bus	3.55	0.60	9.04	1.69	8.02	22.90	0.40	0.40	0.80	23.70	
		Sub-total	3.81	0.60	9.92	2.89	9.10	26.31	0.41	0.41	0.82	27.13	
ENTS	83		7.09	0.96	5.54	1.05	4.78	19.41	0.22	0.36	0.58	19.99	149.99
ENTS	87		8.33	1.15	6.26	1.27	5.34	22.36	0.20	0.42	0.61	22.97	165.09
ENTS	20L		11.00	1.53	9.67	1.67	9.21	33.07	0.26	0.42	0.68	33.75	236.25
ENTS	20H		16.73	2.32	14.50	2.49	14.45	50.49	0.65	0.73	1.38	51.88	373.41
Car Passengers													
CAS	85/86	Car	0.83	0.13	1.46	0.91	1.45	4.79	0.04	0.04	0.08	4.87	
CAS	85/86	Pickup	1.46	0.13	1.98	0.92	2.39	6.88	0.10	0.09	0.19	7.07	
		Sub-total	2.29	0.26	3.44	1.83	3.84	11.67	0.14	0.13	0.27	11.94	
ENTS	83		0.70	0.10	1.77	0.10	1.77	4.43	0.19	0.19	0.37	4.80	72.54
ENTS	87		1.88	0.45	3.39	0.42	3.35	9.49	0.35	0.34	0.69	10.18	152.20
ENTS	20L		2.97	0.77	6.00	0.72	6.03	16.49	0.58	0.58	1.16	17.65	252.47
ENTS	20H		4.28	1.08	9.05	1.06	9.04	24.51	1.00	1.02	2.02	26.53	361.57
Taxi Passengers													
CAS	85/86	Taxi Car	1.51	0.90	4.12	3.70	4.31	14.54	0.20	0.19	0.39	14.93	
CAS	85/86	Taxi Van	1.27	0.20	1.83	4.11	1.96	9.37	0.03	0.02	0.05	9.42	
CAS	85/86	Taxi Pickup	0.18	0.01	0.22	0.80	0.07	1.27	0.00	0.00	0.00	1.28	
		Sub-total	2.96	1.11	6.17	8.61	6.34	25.18	0.23	0.21	0.44	25.63	
ENTS	83		4.36	1.17	6.51	1.18	6.77	20.00	0.79	0.70	1.49	21.50	257.26
ENTS	87		5.97	1.71	9.38	1.71	9.37	28.14	1.19	1.22	2.40	30.55	385.43
ENTS	20L		7.42	2.34	14.57	2.31	14.62	41.26	1.61	1.75	3.36	44.61	514.85
ENTS	20H		9.83	3.02	18.95	3.04	18.84	53.68	2.09	2.16	4.25	57.94	682.64

Sources: ENTS -- Egypt National Transport Study Phase III, 1984
RR -- Egyptian National Railway Authority
CAS -- Study surveys

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Car passenger estimates by ENTS were probably overstated, but the situation was a little confused by the role of pickups which are often used like a private car.

Conclusions on Future Passenger Transport - Statistics from the Roadside Interview Survey conducted by this Study tended to confirm the ENTS traffic estimates for the 1983-1987 period, despite the fact that economic growth had been lower than assumed by ENTS. Rail passenger statistics, on the other hand, showed significantly lower volumes than expected by ENTS, although ENRA were confident about catching up with the ENTS forecasts. However, the assessment of the Study railroad specialist was that the Railways had much to do to improve their operations, and that the ENTS forecasts could therefore be regarded as optimistic.

The overall conclusion of the Study was similar to that reached on freight transport; namely that growth in road passenger transport was unlikely to be significantly affected by changes in other modes (in this case just the railways). Sensitivity tests in the evaluation phase examined the consequences of lower road passenger growth which could be caused at least in part by new developments on the railways.