ANALYSIS OF TRANSIT USERS AND MODE CHOICE ON A MAJOR METRO CORRIDOR (HELWAN/RAMSIS) IN CAIRO

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INTRODUCTION

With a population of over 12m in 1990, over 16m inhabitants are expected to live in Greater Cairo (GC) by the turn of the century. The great majority of the dwellers of GC have been always depending on transit modes in satisfying their daily travel needs. In the late 1980's, for instance, it was estimated that 65% of daily motorized trips occurred on transit modes (1); before metro operation.

The transit system in GC is at the moment composed of the formal modes (bus, minibus, light rail, Nile ferry and the metro) and the informal shared taxi. The metro service was introduced in 2 successive phases in 1987 and 1989, respectively. This regional line is 42.5 km length extending from Helwan in the extreme south of Cairo to El Marg at the northern peripheral of the capital as shown in Fig. 1. Phase I covered the length from Helwan to Moubarak stations crossing the CBD in an underground section composed of 5 stations. Whereas in phase II the line was extended to its full length. During phase I the trains ran with 6 coaches achieving a daily ridership of 280000 trips. The latest statistics of phase II show that over 800000 trips per day are taking place on the metro corridor with 9 coaches trains. A new urban line is under construction since 1991.

During the 1980's discussions on metros viability in developing countries started to take place. Participation included researchers, doner countries, international funding agencies and the concerned developing countries authorities. Many diverting views emerged; in favour, against and undecided (e.g. 2,3). Several research work were carried out in that respect (e.g. 4,5). In 1988 INRETS started a joint effort with the DRTPC of Cairo University which concentrated on phase I of Cairo regional metro line. The aim was to investigate the features of phase I including three elements; operation characteristics, cost/revenue, and transit mode choice on the corridor. The report was published in 1990(6). It is

hoped that similar work can be achieved to cover phase II with the metro line operating in its full length and also to repeat the study, if possible, on metros in other developing countries. Such effort is very useful to all concerned bodies.

The present paper highlights the main findings of the third element of the above mentioned report (6). It therefore, concentrates on the Helwan/Ramsis corridor (HRC) on which phase I of Cairo metro was operating, presenting the results of a questionnaire with the users of the 3 competing transit modes. The analysis includes users socio-economic status, transit usage and mode choice features.

1.IDENTIFICATION OF THE HELWAN/RAMSIS CORRIDOR (HRC)

HRC is one of the major transit corridors in Cairo. It starts from the extreme south at Helwan suburb heading on to the extreme north of the city centre at Ramsis square. The corridor passes through the industrial estates near Helwan, then it passes the high income suburb of El Maadi and the heavy residential area of Dar El Salam and goes on to the city centre through Tahrir square before it finally reaches Ramsis square (see Fig. 2). Three transit modes operate regularly on this corridor; the metro, the bus and the shared taxi.

As shown in Fig. 2 the exact route of the bus and shared taxi lines differs from that of the metro as they take the Corniche ave. after leaving Helwan, then they enter into the city centre from Kasr El Ainy st. near El-Malek El-Saleh metro station. However, they are almost parallel to the metro route. The analysis was made on 6 bus lines and 3 shared taxi lines that were competing with the metro.

The demand on the HRC is always seen to be very high as buses run in full passenger load as well as shared taxies; almost all the day. However, the metro usage seemed to be very high during peak periods as naturally should be the case. Metro usage in phase I was about 280000 passengers per day. Whereas, daily bus passengers on the selected 6 lines were estimated at 53000 (6). No data was available on shared taxi usage on the corridor. However, a rough estimate gave a figure of 20000 pass./day (6). Hence, modal share on the three competing services is estimated at 79%, 15% and 6% for metro, bus and shared taxi, respectively; a quite expected estimate if one looks at the carrying capacity of each mode.

Figure 1

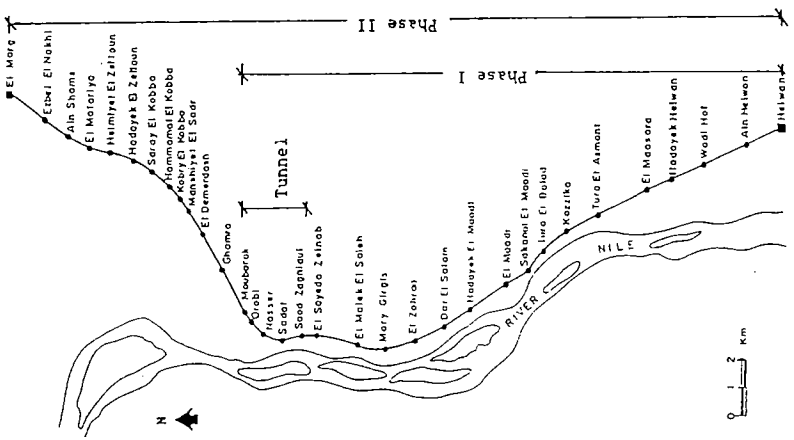
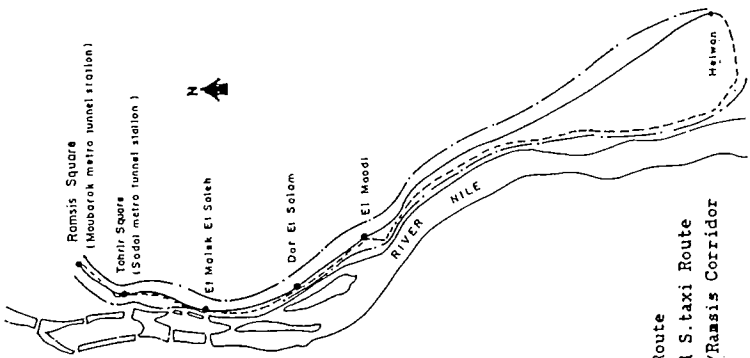


Figure 2



Average fares on HRC, (7)

Trip Purpose		Metro	Bus	S.T.
Work	LE	0.18	0.10	0.40
	¢	0.05	0.03	0.12
Educ.	LE	0.10	0.04	0.37
	¢	0.03	0.01	0.11

1 LE = 3.3 ¢

Ave. in-veh. time* on HRC, (7)

Purpose	Metro	Bus	S.T.
Work	23	37	33
Educ	26	40	35

* mins

Metro Route
Bus and S.taxi Route
Helwan/Ramsis Corridor

The fare structure on the corridor differed by mode, trip length and user type as on metro and bus special fares are available for students and on metro government and public sector workers have special fares. Furthermore, reduced seasonal tickets and passes are available on metro and bus, respectively. Estimates of average fares and in-vehicle times based on a sample of travellers on the corridor (7) are shown on Fig. 2.

2.THE QUESTIONNAIRE WITH TRANSIT USERS

One of the major data collection effort of the above mentioned research work (6) was a questionnaire with a sample of 5500 users of the 3 competing modes on the HRC. The sample share for metro, bus and shared taxi was 73%, 18% and 9%, respectively. Thus, it reasonably matched the above mentioned usage share of the 3 modes on the HRC. Of course the questionnaire was undertaken when the metro was operating under phase I. Had the work been carried out after phase II the picture would have been distorted. Metro operation to El-Marg would have created another dimension of mode competition on the corridor, as the considered lines of bus and shared taxi, were operating only between Helwan and Ramsis square.

The questionnaire took place at metro stations and the end termenii of bus and shared taxi lines. The forms included 3 basic types of question aiming at: registering user characteristics, type of fare, information on made usage and the reason(s) for using the mode under consideration and those for not using either of the other competing modes.

3.USERS CHARACTERISTICS

Three main characteristics of the users of the 3 competing modes on the HRC were investigated based on the questionnaire results. These are, sex, age group (<20, 20-60 and >60 years) and occupation (student, pub. sec. & gov. emp., private sec. worker and others). The identification of the users socio-economic levels was difficult as expected. A trial was made, however, to allocate income levels based on the location of residence of the trip maker; but was unsuccessful due to heterogeneity of income levels within the residential zones.

Table 1 gives the percentages of users characteristics among the sample interviewed on a working day on the HRC by mode. The main comments follows.

Table 1

User characteristics		Mode		
		Metro	Bus	Shared taxi
Sex	M	74	77	93
	FM	26	23	7
Age	<20	8	6	3
	20-60	91	87	96
	>60	1	7	1
Occupation	S	21	13	8
	PS&G	54	35	45
	PRS	19	31	44
	O	6	21	3

M=male FM=Female S=student PS&G=pub.sect.& gov.emp.
PRS= private sec.workers O=others

- The percentage of male travelers was ⩾ 74% irrespective of the used mode. In the case of shared taxi this percentage reached 93%, however. This can be related to the driving behaviour practiced by shared taxi drivers and the characteristics of the service itself. For instance, shared taxi drivers especially on the HRC are known to drive fast taking advantage of the part of the route along the Cornish ave.; a 6 lane divided facility. Such trend is of course considered as unsafe by women. Furthermore, it was noticed during the survey that the majority of shared taxi passengers are of the young private workers, on building and mechanical professions, many of them are fond of high speeds, listening to the radio during the journey and smoking; which are possible on shared taxis. Such behaviour can in many cases annoy female passengers.
- The greatest percentage of travelers are always between 20 and 60 years old. This is quite reasonable since this group comprises students and employees who travel during the peak. However, children of less than preparatory school level were not included in the sample for practical reasons.
- The highest percentages of the <20 years old passengers occurred on the metro and bus. This is mainly due to the highly reduced students fare on these two modes which does not apply to shared taxis.
- The greatest percentages of student users occurred on the metro. Although bus students fare is slightly lower than that of the metro, yet it seemed that students preferred metro since its level of service is higher. Government and public sector employees also take advantage of the offered reduced fare on the metro as can be noted from their high percentages on this mode, especially during peak periods. Confirming the argument mentioned earlier, it is

clear that the travelers belonging to the private sector are fond of the shared taxi as their percentage reached nearly the same of those belonging to the public sector and government group. Also the percentages of the private sector users on shared taxi are always higher than those on the other two modes, especially the metro. This again may be due to the relatively high cost of the seasonal ticket offered on the metro service for this group of travelers compared to that for government and public sector employees.

Based on observations during the questionnaire the following impression was recorded on the types of user by mode.

- Metro users seem to belong to the middle class travelers who can afford the relatively high fares, and the low income class who enjoy the highly subsidized seasonal ticket. The latter are government and public sector employees and students.
- Bus users are always from the low income groups who cannot afford fares of metro and shared taxis.
- Shared taxi users gave the impression that they belong to the young age middle income private sector workers who can afford the fare. It may be argued, therefore, that such travelers can also afford metro fares. However, it seemed that this group enjoys traveling on shared taxis for specific reasons as mentioned above.

4.CHARACTERISTICS OF TRANSIT USAGE ON THE CORRIDOR

Table 2 gives the percentages of regularity of usage, no. of times the mode is used daily and trip purpose among the interviewed sample on the HRC by mode and travel period. The main comments are given below.

Table 2

Feature \ Mode		Metro				Bus				Shared taxi			
Regularity		D	WK	NR		D	WK	NR		D	WK	NR	
	Weekday	70	13	17		41	13	46		53	19	28	
	Weekend	49	20	31		20	17	63		19	24	57	
No. of times the mode is used per day		1	2	3+		1	2	3+		1	2	3+	
	Weekday	9	87	4		34	65	1		28	71	1	
	Weekend	18	79	3		42	57	1		32	68	--	
Trip purpose		W	E	S	O	W	E	S	O	W	E	S	O
	Weekday	63	19	1	17	49	10	3	38	67	6	4	23
	Weekend	37	9	5	49	13	1	9	77	31	1	7	61

D = day , WK = weekly and NR = non-regular
W = work, E = education, S = shopping and O = other

* Regularity of usage,
- Daily usage is always the highest for metro travelers irrespective of the travel period. On the weekend non-regularity of usage was nearly double that recorded in the weekday.
- Non-regularity of usage appears to be the highest among the bus interviewed sample especially during the weekend. This may be attributed to the low regularity of buses operating on the HRC and the crowdness of vehicles, which force the travelers to use alternative modes in some days.
- For the case of the shared taxi sample regularity of usage was the highest during the weekday and the lowest during the weekend. As mentioned earlier the private sector workers who were spotted to be the majority of this mode users are in vacation in the weekend. Hence, the mode seems to be used by other travelers on weekends.
- Daily usage of the metro is by far the highest among the other two modes during weekdays which is quite logical.
* No. of times the mode is used daily,
- Using the mode twice daily, apparently for work, education and shopping trips, is a dominant feature for all the 3 modes irrespective of the time period.
- However, for metro the trend of using the mode twice daily is much higher than using it less (1 trip) or more frequent. This is again a main feature of using metros.
- In the cases of bus and shared taxi the relatively high percentages of the respective interviewed sample indicated that many people used the mode once a day only. This means that in many cases the travelers use a different mode for the return to home (or going to work), for example, than that used for the reverse trip. This may be due to irregularity and/or crowdness of bus and/or shared taxi operating on the HRC.
* Trip purpose,
- As expected work trips are dominant for weekday travel on the metro; a main feature of metro usage. Education trips also seemed important on the metro compared to the other two modes.
- For shared taxi similar trend occurred for work trips.
- For weekend trips the 3 modes are used more for travel purposes other than work, education and shopping; an expected feature of weekend travel.
- For bus trips, however, the work purpose was dominant during peak and weekday periods.

Furthermore, some features of metro usage were investigated (6), e.g. the type of fare and the mode used, if any, to complete the journey in addition to the metro.

Examining the split of the indicated type of fare among the interviewed sample of users of phase I of Cairo regional metro indicated the following.
- The highest percentage of passengers holding seasonal tickets exists in the case of peak travel (69%). This matches the global statistics of tickets sales on phase I.
- During off peak and weekend, however, the percentage of single ticket users is approaching 60% with the remainder, are seasonal ticket holders. This is also logical since some people are expected to use the metro only during off peak and weekends to, for example, shopping in the city centre. Here since such trip is not repeated very often it is cost effective to purchase a single ticket to enjoy the high level of service.

Analysis of the percentages of the indicated mode used in addition to the metro to complete the same journey among the interviewed sample of users of phase I by travel period (whether the additional mode was used "before", "after" or "before and after" the metro link of the journey) revealed the following comments.
- Nearly 46% of the users indicated that no other mode is used during peaks, off peak and weekday travel.
- Generally almost half of the interviewed sample walk to/from the metro station from/to the origin/destination of the trip, irrespective of the travel period.
- Nearly, one quarter of the users indicated that they use the bus in addition to metro and always 16% indicated that they use the shared taxi.
- In view of the high percentages of passengers indicating they use another mode to complete the trip it is clear that coordination between metro and other modes is very important. In addition, the concept of a unified ticket appears to be very important when considering the question of fare policy. For more details about the proposed coordination between metro and other modes in Cairo refer to (1 & 6).
- Private car usage in addition to metro is very low. This may be due to the low car ownership level in Cairo in addition to: (a) it was very early when the questionnaire was undertaken (16 months after metro opening) for the park and ride travel habit to be developed, and (b) park and ride facilitates around metro stations were not sufficient during that period. Gradually these facilities are being provided; now after 4 $^1/_2$ years of metro operation the situation has changed.

5.ANALYSIS OF MODE CHOICE FEATURES ON THE CORRIDOR

Table 3 gives the percentages of the indicated reasons of choice of a transit mode and non-choice of the other two alternative modes among the interviewed sample of transit users on the HRC during a weekday. It appears that the main reason indicated by metro users for choice of metro is "fast", while "crowded" and "expensive" came as the main reasons for not choosing the bus and the shared taxi, respectively. The bus users, on the other hand, indicated that they choose the bus because it is "cheap" while they find the other two alternatives "expensive". As for the shared taxi users, the reason for their choice was "fast". Whereas they neither chose the metro because it is "far" from their origin (and/or destination) nor did they select the bus because it is "crowded".

Table 3

Users of mode	Choice/ non-choice	Reason of Choice/non-choice															
		Fast	Slow	Direct	Indirect	Regular	Irregular	Close	Far	Cheap	Expensive	Safe	Unsafe	Comfort	Crowded	Read.Avail	Others
Met.	CM	29	-	6	-	14	-	10	-	3	-	2	-	25	-	-	11
	NCB	-	23	-	5	-	10	-	11	-	-	-	-	-	42	-	9
	NCST	-	-	-	8	-	8	-	17	-	22	-	4	-	18	-	23
Bus	CB	-	-	7	-	-	-	24	-	48	-	-	-	4	-	8	9
	NCM	-	-	-	10	-	-	-	26	-	46	-	-	-	-	-	18
	NCST	-	-	-	5	-	3	-	9	-	54	-	1	-	4	-	24
S. Taxi	CST	37	-	13	-	-	-	22	-	4	-	-	-	9	-	-	15
	NCM	-	14	-	18	-	-	-	46	-	4	-	-	-	5	-	13
	NCB	-	20	-	5	-	18	-	2	-	-	-	-	-	50	-	5

CM= choice of metro, NCB= non-choice of bus,
NCST= non-choice of shared taxi.

Table 4 is a comparative table that gives the percentages of reasons of mode choice and those of non-choice of mode among the interviewed sample for each mode users on the HRC during the weekday period. The main conclusions from this table are given blow.

Table 4

Mode choice				Non-choice of mode						
					Metro		Bus		S.Taxi	
Reason	Metro	Bus	S.Taxi	Reason	BU	STU	MU	STU	MU	BU
Fast	30	--	37	Slow	--	14	23	20	--	--
Direct	6	7	13	Indirect	10	18	5	5	8	5
Regular	13	--	--	Irregular	--	--	10	18	8	3
Close	10	24	22	Far	26	46	11	2	17	9
Cheap	3	48	4	Expensive	46	4	--	--	21	54
Comfort	25	4	9	Crowded	--	5	42	50	19	--
Safe	2	--	--	Unsafe	--	--	--	--	4	1
Others	11	17	15	Others	18	13	9	5	23	28

BU= bus users, STU= shared taxi users & MU= metro users

5.1.For the Case of Mode Choice

- The main reasons of choosing the metro are "fast" and "comfort", for the bus these are "cheap" and "close", and for the shared taxi these are "fast" and "close".
- It appears that safety is not a matter of choice among the interviewed sample. An explanation may be that many people believe that if an accident is going to occur then it will occur regardless of the used mode.
- Regularity of service was not a choice criterion for bus and shared taxi but logically it appeared in the case of metro.

5.2.For the Case of Non-Choice of Mode

- The main reasons for non-choice of metro are "expensive" for bus users, "far" and "indirect" for bus and shared taxi users. This reflects the effect of the relatively high cost of the single journey ticket of the metro compared to the bus fare. Furthermore, the strictly fixed route of the metro made it far from some users of the bus and shared taxi more flexible routes. As "indirect" appeared an important reason for non-choice of metro it reflects the importance of the question of mode transfer if one uses the metro. Hence, it emphasizes the need of some sort of unified multi-mode ticket in the context of a new transit fare policy.
- The main reasons for non-choice of bus are "crowded", and "slow". These are very logical reasons.
- The main reason for non-choice of shared taxi is "expensive". This is because its fare is much higher than that of the bus and of the seasonal ticket on the metro.

- Irregularity of service as a non-choice reason appeared only in the cases of bus and shared taxi. This confirms the metro feature as a highly regular service.
- The question of safety appeared only in the case of shared taxi non-choice reasons. This reflects what was mentioned earlier about fast driving of the shared taxi drivers.

6.CONCLUDING COMMENTS

Analysis of transit users, features of usage and mode choice are topics of high concern to the transport planner and engineer especially in developing countries. This is mainly because such modes are heavily used and will continue to be so for years to come. This paper highlights the type of analysis warranted in these respects. It is hoped that researchers in both the developing world and those concerned with it in the developed countries are encouraged to do so. This will certainly help in establishing a wider view and in depth understanding of the mater from many diverting and interacting points of view. On top are the nature of transit users; who are they? what are their needs? how they use transit? and above all why they choose certain transit modes and not others?

Of course the answers of the above questions vary from a person to another, from a situation to another and from a city to another. However, they can reveal many aspects of the needed transit services. Thus, furnishing the way on which transit improvements and provision policies and decisions can be made in a realistic manner. Certainly additional multi criteria evaluation effort is needed. Nevertheless, it must be coupled with thorough investigation on transit users, usage and choice if the travelers points of view are to be considered. It is for the sake of helping those travellers politicians, operators and doner agencies work to provide appropriate policies, projects and aid.

The present work is hoped to act as a step in that direction.

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