MINIBUS OPERATIONS ALONG LOMAGUNDI ROAD, HARARE

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ABSTRACT

A study of minibus transport operations on a selected section of a district distributor road in Harare was undertaken with the objectives to estimate journey speeds, minibus flows and other characteristics in mixed traffic streams during morning peak periods. The method of moving observer was applied and journey times measured. Ranges of journey times, time mean speeds and minibus flows by groups of morning time periods and weekdays were estimated. Observations and records concerning utilisation of the road carriageway, drivers' and passengers' behaviour and the impacts of minibus transport mode upon the traffic streams and the physical environment of the road complemented the results. Recommendations based on the study are offered in order to assist toward a sustainable development and improvements of the minibus transport mode.

INTRODUCTION

In the last five years the urban/semi-urban transport in Zimbabwe has experienced significant positive changes enabled by decentralisation and liberalisation policies. A new minibus transport mode run by private operators was vigorously introduced. Currently hundreds of privately operated "omnibuses" provide passenger transport in inter-urban areas.

This transport mode plays significant role in the mobility of high percents of urban populations as captive passengers for work, school, social and other trips. It is expected that in medium terms it will continue providing for population mobility. In long terms it will probably become a major feeder and shuttle mode in an integrated seamless transport system related to land uses and based on major transit modes.

The planning and management of this transport mode as foreseen and provided for should ensure a desired high efficiency in operations. Policies, management regulations, registrations and control systems applied by the Authorities are most important aspects in this direction. However, more detailed studies of operational aspects of minibus transport may contribute significantly toward its sustainability and efficiency.

OBJECTIVES

The study of minibus transport along Lomagundi Road in Harare was undertaken in order to acquire more detailed knowledge about the modal operations on a suitably selected urban road. The objectives were as follows:

- To collect and analyse data of minibus speeds and flows in West-East direction during morning peak periods in conditions of mixed traffic operations;
- To investigate the behaviour of minibus drivers in a specific urban environment;

- To investigate the patrons' behaviour as related to the minibus services offered;
- To analyse the impact of minibus operations upon the physical environment of the road section.

The study is based on observed and recorded facts. Any prior information about numbers of private operators and their minibuses operating along the road section, as well as the destination lines and their routes outside the observed section, were irrelevant to this study.

Although the study is related to particular road section and traffic conditions, it is expected that the findings, conclusions and recommendations may assist in the development of this transport mode and further decision making in the transportation and urban planning sectors of activities and management.

METHOD AND SITE OF STUDY

For the study the moving observer method was applied in weekday morning peak periods on a selected section of Lomagundi Rd, Harare. Records of measured journey times in mixed traffic flows and factual observations concerning minibus operations were kept. This method is well known (3, 4, 5). It requires a minimum of 6 to maximum of 16 runs by the observer's vehicle (1, 2) for collecting sufficient and reliable data. Records about drivers' and patrons' behaviour were also kept. Altogether 51 independent two-directional runs were carried out from 7,20 to 9,00am.

The section of Lomagundi Rd, Harare between the intersections with Stoney Rd – Greencroft Shopping Centre and King George Rd of 2,7 km length was selected as suitable district distributor road. Some observations were recorded on a longer section of 3,2 km to the intersection with the Second Street Extension. The selected road section is part of minibus routes, which provide links between residential, e.g. Marlborough, Mabelreign, Westgate etc., employment and the Central Business District (CBD) areas.

The road section of 3,2 km has 4 relatively distinguished subsections as follows:

- A subsection of 1 750m from Stoney Rd to Belfast Rd with signal controlled intersections at both ends and a carriageway of one lane in each direction;
- A subsection of 250m from Belfast Rd to West Rd with one additional slip lane;
- A subsection of 700m from West Rd to a signal controlled intersection at King George Rd with two lanes in direction;
- A subsection of 500m from King George Rd to the signal controlled intersection at Second St Extension with two lanes in direction.

Preliminary trials have shown that meaningful results can be obtained in applying the method between the intersections of Lomagundi Rd with Stoney Rd and King George Rd at a length of 2,7km, thus despite the different carriageways in the last sections. This was due to the prevailing morning peak conditions on the main section of 1,75 km where all vehicles principally follow each other at approximately constant speed. Overtaking maneuvers were almost impossible and the minibuses used the shoulder and the adjacent reserve land for overtaking other vehicles. This fact required a careful appreciation of numbers of minibuses overtaking the observer's vehicle and those overtaken by it.

The runs were carried out with a passenger car travelling at the prevailing speed in west-east direction and immediately thereafter in the opposite east-west direction. The journey times for each section, rounded to a half minute, were recorded at arrival. The dwell times at signals at the beginning and end of the route

were omitted. In this way the measured journey times used in calculations according to the method contain occasional red intervals at Belfast Rd intersection only.

The collected data from the directional runs of the moving observer were as follows:

- The journey times while travelling with the studied stream in W-E direction and while travelling against the stream in E-W direction;
- The number of minibuses overtaking the observer's vehicle minus the number of minibuses overtaken by the observer's vehicle while travelling with the stream;
- The number of minibuses met while travelling against the stream.

The data were used to calculate average journey times, average time mean journey speeds and average minibus flows by time and weekday groups according to the moving observer method. The data were analysed statistically and ranges of journey time, speed and flow were estimated respectively. The results are presented in Tables 1 and 2.

Other data, considered as important in minibus transport mode operations and a quality of service provided, were also collected, as follows:

- Minibus drivers' behaviour, including utilisation of the road carriageway and the performance of overtaking maneuvers, stopping for passengers, impacts on traffic streams and the environment of the road with records of minibus registration numbers where possible and/or numbers of minibuses involved in particular maneuvers where the conditions did not allow reading the registration plates;
- Numbers of potential passengers waiting minibus transport at various locations and stops;
- Facts related to the environmental impact of the minibus transport and its physical consequences.

STATISTICS OF COLLECTED DATA

The 51 two-directional independent observations cover one fifth or 20,24% of the 252 weekdays in Zimbabwe. These include 11 weekdays or 21,5% of the total number carried out during school vacations, i.e. 3 days in January and 8 days in April 1999. The rainy season did not affect significantly the study because of the road and the prevailing traffic conditions in morning peak periods, which allowed the vehicles only to follow each other on the main section. The environment at ground level around the road was more affected.

The observations were into 6 time groups and analysed separately, as well as one major group from 7,20 to 8,00am, comprising 44 observations or 86,3% of the total number. The groups by time period were as follows:

- From 7,20 to 7,25am - 6 observations or 11,8%;
- From 7,26 to 7,30am - 13 observations or 25,5%;
- From 7,31 to 7,35am - 12 observations or 23,5%;
- From 7,36 to 7,40am - 6 observations or 11,8%;
- From 7,41 to 8,00am - 7 observations or 13,7%;
- From 8,00 to 9,00am - 7 observations or 13,7%.

The analysis by weekdays includes a total of 37 observations from 7,20 to 7,40am, as follows:

- Monday, Wednesday, Thursday and Friday: 8 observations or 21,61% for each weekday;
- Tuesday: 5 observations or 13,51%, which is one less than statistically required.

RESULTS AND DISCUSSION

The measured values of journey times and counted numbers of minibuses were used according to the moving observer method for estimating the average values of journey time, time mean journey speed and minibus flow. The results were statistically analysed by groups (1, 3) and the ranges of journey times, speeds and flows were estimated at 95% confidence. The results by time groups and by weekdays are presented in Table 1 and Table 2 respectively.

The estimated average values of journey time, time mean speed and flow and the respective ranges by time groups in Table 1 do not show distinguished patterns. However, the groups from 7,26 to 7,30am and from 7,41 to 8,00am show relatively longer average journey times and lower time mean speeds respectively.

The narrowest ranges of journey times, speeds and minibus flows appear in the group from 7,26 to 7.30am, followed by the ranges in the group of the next 5 minutes. This period probably was the highest peak in mornings. The wider ranges in the other groups indicate fluctuations of the mixed traffic flows, as well as the minibus flows in conjunction with the lack of time schedules of the minibus service.

The summary group from 7,20 to 8,00am shows reliably an average journey time, average time mean speed and average minibus flow with relatively narrow respective ranges that may be accepted as representative values for similar roads.

The tails of the distribution curves are toward higher time values and lower speed values respectively due to the relatively congested road. The minibus drivers competed with time and coped with traffic situations as they could. Probably, the durations of minibus round trips were influenced in the same way by similar road and peak traffic conditions in other sections of their routes.

During the period from 8,00 to 9,00am the average journey time shows a slight increase, may be due to the small number of observations unevenly spread over the hour. The average minibus flow is lower than in the previous periods, thus showing a principal change in the minibus traffic.

TABLE 1. RESULTS BY TIME GROUPS

Time group am	Sample size, No	Average j. time, minutes	Est. range of j. times, minutes	Average j. speed, km/h	Est. range of j. speed, km/h	Average bus flow, B/h	Est. range of bus flow, B/h	Distribution curve toward values* Time	Speed	Flow
7,20-7,25	6	5,9	3,3 – 8,5	28,9	17,1 – 40,7	24	13 – 35	H	L	L
7,26-7,30	13	7,1	5,2 – 8,9	25,9	19,4 – 32,4	20	15 – 25	H	L	H
7,31-7,35	12	6,8	4,8 – 8,8	28,2	19,6 – 36,8	20	15 – 25	H	L	L
7,36-7,40	6	5,8	3,1 – 8,5	30,3	17,1 – 43,5	19	11 – 26	H	L	L
7,41-8,00	7	7,3	4,6 –10,0	23,7	14,9 – 32,5	21	12 – 29	H	L	L
7,20-8,00	**44**	**6,7**	**5,9 – 7,5**	**27,2**	**24,1 – 30,3**	**20**	**18 – 23**	**H**	**L**	**H**
8,00-9,00	7	6,9	4,4 – 9,5	25,1	15,4 – 34,8	16	11 – 21	L	H	L

* The skewness index indicates a tail of the distribution curve toward lower (L) or higher (H) values.

TABLE 2. RESULTS BY WEEKDAYS FROM 7,20 TO 7,40am

Week-day	Sample size No	Average j. time, minutes	Est. range of j. times, minutes	Average j. speed, km/h	Est. range of j. speed, km/h	Average bus flow, B/h	Est. range of bus flow, B/h	Distribution curve toward values* Time	Speed	Flow
Monday	8	8,1	5,2 –11,0	23,2	13,3 – 33,0	20	12 – 27	L	L	H
Tuesday	5**	6,3	2,6 –10,0	29,0	13,4 – 44,7	21	10 – 31	H	L	L
Wednesday	8	5,7	3,4 – 8,0	32,2	20,8 – 43,6	23	15 – 30	H	L	H
Thursday	8	5,8	3,6 – 7,9	30,6	20,5 – 40,8	19	14 – 25	H	L	L
Friday	8	7,1	4,7 – 9,4	24,7	16,2 – 33,3	20	18 – 20	H	L	H

* The skewness index indicates a tail of the distribution curve toward lower (L) or higher (H) values.
** Less than the required minimum of 6 observations.

The results by weekdays in Table 2 show that in Monday and Friday the average journey times were longer and the speeds were lower respectively than in other weekdays. In Wednesday and Thursday the average journey times were shorter and within similar ranges. The time mean journey speeds were within similar estimated ranges. The estimated ranges in Tuesday are not fully reliable due to the sample size.

The above characteristics of minibus traffic should be complemented with other recorded observations that contribute to a better understanding of some operational aspects of this transport mode and may assist in improving its efficiency.

(I) Utilisation of the road carriageway

The minibuses travelled on the far-left side of the single lane in west-east direction and utilised the shoulder of 0,80m and the land strip adjacent to the pavement either for stopping often at occasional spots to pick up passengers or for overtaking unlawfully other vehicles. They slalomed around the light poles from the roadside and performed the maneuvers mostly outside the pavement. This was observed along the section of 1 750m from Stoney Rd to Belfast Rd. In 43 observations the time and registration numbers of 32 minibuses performing these maneuvers were recorded. Considering the umber of those without recorded registration, the same was valid for 69% of the minibuses.

(II) Minibus drivers' behaviour

The inconvenience of the road and the traffic flows determined to a large extent minibus drivers' behaviour in driving on the edge of and outside the carriageway. It appeared that private operators and their drivers tend to gain journey time by somewhat aggressive driving. It was combined from time to time with competing for passengers and therefore stopping wherever potential passengers may be seen.

The observations showed that in terms of utilisation of designated bus stops many drivers did not comply with the regulations. In 43 mornings from 7,20 to 9,00am the registration numbers of 75 minibuses stopping once or more times for passengers at occasional non-designated places were recorded. This is on the average 2 minibuses during each journey. Adding those of non-recorded registrations but doing the same, this behaviour appeared to be a typical pattern.

An example, which should be mentioned, was a spot at the signal controlled T- intersection of Lomagundi Rd with Stoney Rd at the beginning of the studied road section where the minibuses stopped regularly, and continue doing it, between two "No Stopping" signs, located 20m apart.

The erection of shelters last year at some designated bus bay stops along the section provided for a significant and positive change in drivers' attitude. As the records showed, the number of minibuses stopping there was growing. The traffic became more orderly, because the drivers were aware of minibuses exiting from or returning into the stream.

(III) Impact on traffic streams

The observations showed that the minibuses returning into the stream after sudden stopping for picking up/dropping passengers at occasional spots or performing overtaking maneuvers outside the pavement disturbed traffic streams and created some confusions and hazardous situations. The other drivers in the streams were pressured unexpectedly to stop or slow down and give way to minibuses. The following vehicles had to react to such sudden situations and the impact was spreading down the stream.

In a few recorded occasions some minibus drivers used the opposite traffic lane for lawful overtaking maneuvers, but given the road and traffic conditions they obstructed and confused the drivers of the incoming vehicles.

(IV) Patrons' behaviour

Based on observations, the behaviour of potential passengers was related to the minibus service offered. The potential passengers obviously obtained information about itineraries and time schedules by experience. The minibus labels show destinations. There are not posted up time schedules of service.
If there were seats available in the minibuses the drivers would stop at any spot to take passengers. This seemed to be a reasonable explanation for potential passengers waiting along the section at places other than the designated stops.

Passengers were waiting usually 20 to 100m away from the designated stops. At the mentioned already spot between the "No Stopping" signs 2 to 10 and occasionally more persons were recorded waiting for a minibus instead of at the designated stop, which is about 150m away.

In 28 observations from 7,20 to 9,00am a total of 187 passengers waiting at occasional spots were recorded. The records showed on the average 6 to 7 persons for periods of 4 to 10 minutes. The numbers of persons counted at other than the designated stops were usually larger during the earlier time periods.

(V) Impact on the physical environment

The impact of the minibus traffic on the physical environment of the road was and still is visible on the ground. The pavement edges and the adjacent to the pavement strips of reserve land are damaged. Deep routings of more than 160mm, potholes and rough surfaces from driving with the right-hand side wheels on the shoulder and left-hand side wheels outside the pavement are particularly obvious in west-east direction. During the rainy season the situation was worsened.

This destructive impact endangers the safety of minibus passengers and their comfort is greatly compromised. The impact makes the maintenance of the road and its vicinity more expensive. The damages of the minibus vehicles could not be exactly appreciated.

(VI) Other observations

During the study an attempt was made to record the registration numbers of all seen minibuses in both directions from 7,20 to 8,00am in order to find out whether there were some patterns of assignment of vehicles to service lines/routes, time periods or weekdays.

A total of 235 registration numbers were recorded and 152 not recorded. From the recorded registrations 46 were repeating in one or both directions twice or up to 5 times in different days and time periods with 50% repeating only twice. No particular patterns were found by time periods or weekdays.

The relatively small figure of repeating registration numbers may be considered as an indication only that the operators assigned their vehicles to specific routes circumstantially for shorter periods, e.g. daily or weekly.

Not all minibuses had good external appearances. The records show that some vehicles had faint and illegible, dirty or hidden behind bulbar registration numbers. A few vehicles did not have side mirrors and/or the back windows were entirely covered with paint or pictures. A few minibuses had nicknames attached to the registration plates, e.g. "Bush Doctor".

During the study period only 2 minibuses were seen out of operation, i.e. one with a flat tyre being changed near an intersection, and the second, probably with a battery problem, was pushed by the passengers.

CONCLUSION

The study provides grounds for some conclusions and recommendations in view of the sustainability of a minibus transport mode and possible improvements of its operations in medium and long terms.

The conclusions concern the efficiency of the mode in mixed traffic operations on main distributor roads. Although some of the estimated speed and flow values may seem reasonable in the given conditions, they should be regarded in conjunction with the pointed out difficulties in compliance with the road regulations and problems of public convenience. Nevertheless, the estimated values provide guidance in planning for minibus services.

An improvement may be achieved with adequate provisions for suitable road conditions that are conducive to effective operations and services. Usually highly trafficked road sections with mixed flow operations on one only directional lane should be relatively short from 250 to about 500m. This issue is closely linked to the traffic safety and the safety and comfort of passengers. It is also related to a desired protection of the physical environment of major transportation routes.

Satisfactory minibus operations and services are in the common interest of both the public and private sectors in social, financial and environmental terms. Therefore, the major recommendations, arising from the study, have to be addressed to the relevant public executive and management authorities and the private operators according to their respective responsibilities.

The recommendations may be summarised, as follows:

- For a sustainable development and effective operations of the minibus transport mode appropriate urban routes should be established and should be upgraded where necessary;
- Priority should be given to physical improvements of distributor road sections used by large mixed traffic flows, thus including widening with additional lanes. On relatively long sections of dual two-lane carriageways an additional lane within the existing road reserve where possible, as it is the case of the studied Lomagundi Rd section, may improve significantly the operational conditions of the vehicular traffic and the efficiency of the minibus transport mode;
- Bus stops should be designated at appropriate locations with bays of suitably finished road levels and equipped with relevant signs, shelters and posted up public information about the minibus service;
- Minibus operators should provide passengers with the needed information about the services offered according to their contracted itineraries. The time schedules have to be based on studied and planned demands and routes according to attainable journey speeds. A flexible but still reliable manner of supplying information to the public has to be chosen, thus including beginning and end of daily service and frequency of service during the day with relevant intervals of arrival in specified daily periods;
- Assuming gradually improved road conditions on critical route sections, the minibus drivers must be trained and encouraged toward good driving habits and compliance with road regulations;
- Private operators must require a proper performance of their drivers as a means of achieving the company objectives and protecting the wear of minibus fleets;

- Road unworthy minibuses should be prohibited from operations and appropriate systems of control of vehicles have to be applied by the relevant management authorities and the private operators themselves;
- A suitable system of contracting with private operators should have regard for manageable internal systems of allocations to minibus transport lines and routes and assignments of drivers and vehicles respectively that may contribute to encouraging a fair competition, based on quality of provided services;
- The suitability of urban roads for minibus operations in mixed traffic conditions along the major passenger transportation routes and their routine and periodic maintenance have to be regarded as a reasonable and affordable way in preserving the physical environment from undesired damages and most importantly in avoiding excessive expenditures in future.

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