

ORIGIN-DESTINATION SURVEY FOR PORT LOUIS
- November 2004 -

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ANNEX

- a - Data Collection Form “Cross Section Count” – *Main Report*
b - Data Collection Form “OD-Survey” – *Main Report*

Evaluation of Cross Section Count

- c - 84 Tables - original counted data (15 minute intervals) and conversion into PCU – *Annex 1*
(one table for each station, each day, each direction: 6 x 7 x 2)
d - 84 charts on 28 pages “PCU volumes in 15 minute intervals” – *Annex 1*
(one chart for each station, each day, each direction: 6 x 7 x 2)

Evaluation of OD-Survey

- e - 42 Tables “Ratio of Counted to Interviewed Vehicles” – *Annex 1*
f - 42 x 6 Sheets “Matrices of hourly surveyed OD-volumes” – *Annex 1*
g - 42 x 6 Sheets “Matrices of total hourly OD-volumes” – *Annex 2*
h - 42 Sheets “Matrices of total daily OD-volumes”, 6 stations x 7 days – *Annex 2*
i - 21 Sheets “Matrices of total hourly OD-volumes”, sum of all stations x 7 days – *Annex 2*
j - 9 Sheets “Matrices of total hourly through traffic volumes”, sum of all stations / weekdays /
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k - map “traffic volumes between Port Louis and the 8 other OD-zones - weekdays” – *Main Report*
l - map “traffic volumes between 6 OD-zones generating through traffic in Port Louis - weekdays” –
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n - map “traffic volumes between 6 OD-zones generating through traffic in Port Louis - Sunday” –
Main Report

1 GENERAL

Port-Louis, the capital of Mauritius, is the main attractor of traffic given its scope of activities which range from office to commercial to residential to mix interactions. Objectively, the main accesses leading towards this district are daily saturated ones with long time delays incurred to peak hours' road users. Their converging presence along such corridors within such confined periods is the key to understand the poor levels of service presently experienced by one and all.

The Mauritian Government has subsequently decided to analyse the traffic situation in the capital, Port Louis, so that a guiding comprehension of the trip distribution could be apprehended. As a reliable technical basis for the proposal of adequate problem-solving improvement measures, the present traffic flows have to be analysed. Within the scope of this study, focus has been laid on determining the amount of "through traffic" that does not have its origin or destination in Port Louis. Any proposed future traffic management or road design project has to be tested as against its effect on relieving the city and the waterfront in particular from through traffic.

The present Report comprises of this Main Report and of Annex 1 and Annex 2 as separate volumes.

2 METHODOLOGY

In the Terms of Reference (ToR), sub-sections under 'General implied works' cover the methodologies to be adopted. The different requirements have been critically considered as hereunder detailed.

2.1 Survey Method

The method to collect data has been the road-side interview. Six (6) stations have been located in such a way as to grid out all entrances and exits of Port-Louis, the study zone. Figure 1 illustrates the six locations.

According to the plan given in the ToR the survey was executed along 6 arterial roads that carry the major portion of traffic going to and coming from Port Louis. Three of the survey sections were located north of the city, three in the south. The various locations are given hereunder and as an indication, for ease of reference, S1o means Station 1 outwards movement, S1i means Station 1 inwards movement, etc.

Location	Station	Direction	Site view
Quay D (M2 Motorway)	S1o	Northbound	PLATE 1
	S1i	Southbound	PLATE 2
Rte Nicolay	S2o	Northbound	PLATE 3
	S2i	Southbound	PLATE 4
Rte des Pamplemousses	S3o	Northbound	PLATE 5
	S3i	Southbound	PLATE 6
M1 Motorway <ul style="list-style-type: none"> • Soreze (M1 Motorway) • ESSO (Cassis – M1 Motorway) 	S4i	Northbound	PLATE 7
	S4o	Southbound	PLATE 8
Cite Vallijee	S5i	Northbound	PLATE 9
	S5o	Southbound	PLATE 10
Old Moka Road <ul style="list-style-type: none"> • Plaine Lauzun (3rd Lane) • Exit on Old Moka Road - Old Moka Road 	S6i	Northbound	PLATE 11
	S6o	Southbound	PLATE 12

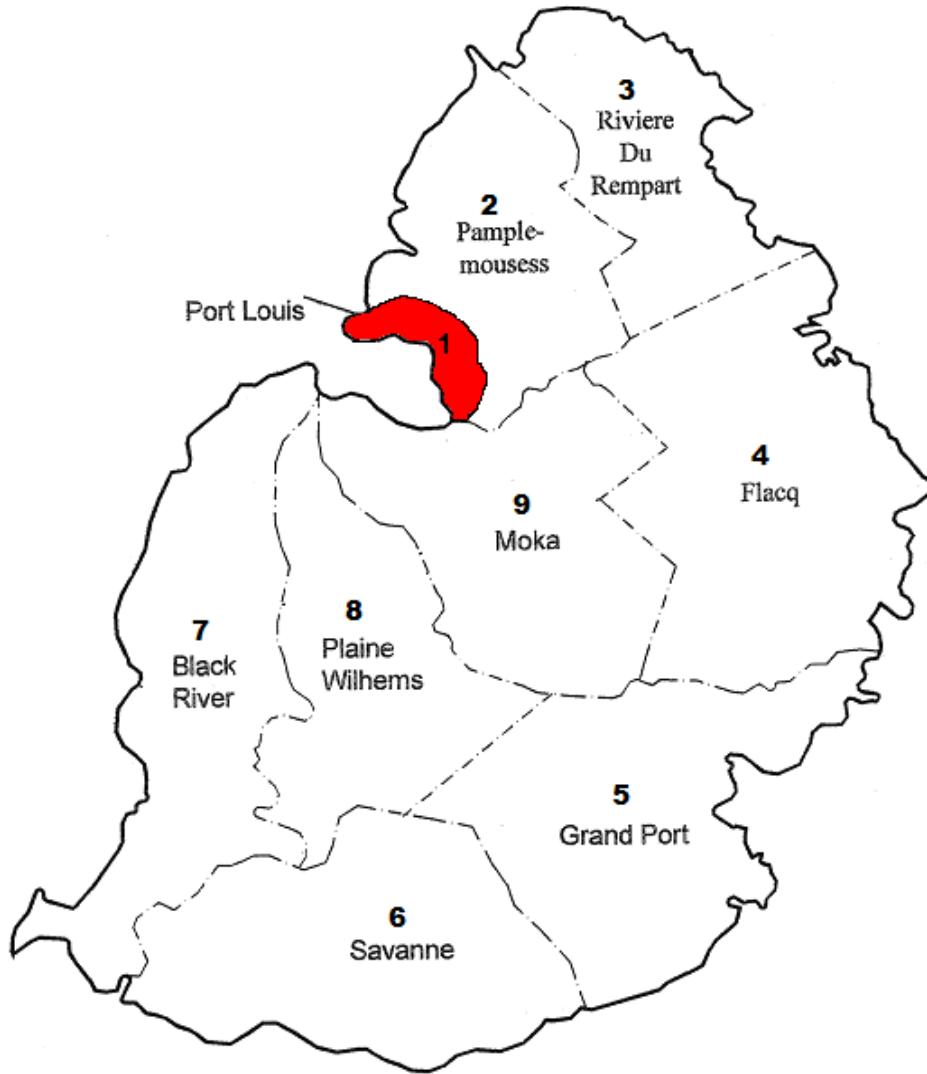
At all the six locations, traffic counts and roadside interviews were carried out in both directions - inbound and outbound - drivers were interviewed regarding the origin, destination and purpose of their trip. Additionally, intermediate trips were also recorded. The forms used for these exercises are presented as **annex a** (cross section count) and **annex b** (OD-survey).

Two teams, each comprising of ten persons, were provided at each of the six locations – one team for northbound traffic and one team for southbound traffic. In each team, three individuals were assigned to traffic count and four to five to roadside interviews. The remaining personnel permitted the running of a roster.

2.2 Zoning system

The following Map of Mauritius was zoned by districts, with each district being numbered. Port-Louis was zone 1, Pamplemousses was zone 2 and so forth. This zoning system has been used to build relevant trip matrices.

ORIGIN-DESTINATION SURVEY ZONING SYSTEM



TRAFFIC ZONES

3 DATA COLLECTION

3.1 Programme of Survey

Time Period

According to the schedule as defined within the requirements of the Terms of Reference the traffic surveys – counts and interviews - were executed during one week in November 2004, from 22nd November 2004 to 28th November 2004. The 12 hours between 6 o'clock in the morning to 18 o'clock in the evening were covered.

3.2 Type and Number of Collected Data

Both Cross section counts and roadside interviews were carried out over fifteen minute time intervals.

It may be noted that the following types of vehicles were both counted and surveyed:

- Cars (including taxis)
- Passenger Van
- Private bus
- Van / Pickup
- Trucks - 2 axles
- Trucks - 3 axles
- Motorcycles, and
- Public buses / coaches

It was attempted to catch similar percentages of the various vehicle types as far as possible. For consistency, at the stage of analysis, the following passenger car units have been adopted as per the recommendation of the Traffic Management and Road Safety Unit:

Vehicle type	PCU
Cars (including taxis)	1.00
Passenger van	1.50
Private bus	2.00
Van/Pickup	1.50
Trucks – 2 axles	2.50
Trucks – 3 axles	3.00
Motorcycles	0.80
Public buses/coaches	3.00

3.3 Site Constraints

The Survey was carried out in a rather smooth manner except for the following constraints that limited the number and type of vehicles surveyed, viz:

- The fast-lane (as defined by the right-hand-side carriageway of the Motorway when proceeding towards Port-Louis)

In particular during heavy traffic periods, it was observed that most vehicles use the fast lane (> 60%). Due to the traffic density it was and will be very difficult, if not impossible, to catch these vehicles for interview.



- Length of 'pull-in' space available for interviews.

The longest 'pull-in' road shoulder space was at ESSO on Motorway M1 where it was observed that a maximum of 19 vehicles could be interviewed in five minutes. This quantum could not be reached at other stations for obvious reasons of limited off-street space.



4 EVALUATION

4.1 General / Objectives

The surveyed data base shall be evaluated in a way to provide specific information on the traffic flows and their respective volumes entering Port Louis and coming from there. According to the principal objective of the exercise the final result shall be a statement on the portion of traffic that is not related to Port Louis itself but uses the urban road network on its way from the north to the south or vice versa. In order to achieve this goal, the data are subject to an evaluation process consisting of a series of individual steps.

4.2 Processing of the Surveyed Data

Traffic load on the selected roads are high, especially during the peak periods. They are basically the only main carriers of traffic to and from Port-Louis. This is why these locations have been selected. They are to cover a maximum of the totality of vehicles passing a cordon around the city.

It is obvious that interviews can be done only on a certain percentage of vehicles, or better drivers, passing one of the survey sections. The percentage should be as high as possible in order to obtain representative information. It depends, however, on limiting factors such as available space on the roadside, interviewing capacity (manpower), acceptable degree of interference in the traffic flow with respect to caused delay / queuing and safety. The portion of interviewed driver is different according to the total traffic volume on each of the survey locations. The lower the total volume, the higher the percentage that can be interviewed.

On the motorway which has peak loads of up to 4000 vehicles per hour running at high speed, the achievable percentage is clearly lower than on urban roads with only one driving lane each way. A calculation helps estimating the theoretical survey capacity. If the available lateral space (lay-by) is sufficient to accommodate 4 vehicles at one time and if the interviews including proper filling of the forms take 1 minute, and if clearing the stopping area plus bringing in a new set of 4 vehicles takes 30 seconds, then some 160 interviews can be taken during one hour. This theoretical value has to be reduced a bit because it will not always be possible to fill the bay with 4 vehicle and manoeuvring in and out may occasionally take a bit longer. Hence, the slowest out of the four interviewer or interviewed drivers is determining the entire procedure. And, last but not least, the police officer may not be able or willing to interfere continuously in flowing traffic, so that some gaps occur. From experience, a reduction of the above determined value by some 20 % has to be taken into consideration.

The achievable hourly number of interviews may thus be around 130. During off-peak periods on urban roads that may represent as much as 30 % of the total traffic. On the other hand, during peaks only some 4 % can be covered on the dual-carriageway motorway. Taking into consideration the third lane that is assigned to northbound traffic during morning peak period, the resulting percentage should be even less.

However, any effort has been taken to "catch" similar percentages of the various types of vehicles. As the evaluation shows, this has been achieved to a certain degree only. This is not surprising because during the survey the selection of vehicles to be stopped could only be based on personal judgement and not on the counted numbers of the classified counts effected in parallel.

The process of evaluation consists of a row of subsequent steps. These have been standardized and automated using a set of Excel workbooks, each consisting of a series of spreadsheets. Annexes 1 and 2 include the relevant information.

The process of data computation

1. Counted volumes are converted into passenger car units (PCU) by applying the factors used and recommended by the Traffic Management and Road Safety Unit. The results are presented in the annexed tables "c" and the corresponding charts "d".
2. Comparing the number of interviewed vehicles of each type and comparing these to the total numbers of counted vehicles results in determining the percentage of interviewed vehicles (in PCU) or a multiplication factor as presented in the annexed 42 tables "e".
3. The information of the tables "e" (surveyed OD-volumes) allows to set up a OD-matrix for each of the locations, directions and days. This results in the 42 annexed matrices "f" showing hourly surveyed OD-volumes.
4. Applying the multiplication factors determined under 3) the surveyed OD-volumes are converted into total volumes of each of the respective origin-destination relations. The results are presented in the annexed sheets "g".
5. Basing upon the hourly volumes, the daily volumes are determined, presented in the 42 matrices of the annexed sheets "h".

6. Whereas so far results were still processed separately for each of the survey locations, they are now added up, thus representing the total traffic entering Port Louis on all 6 surveyed corridors, or leaving the city respectively. For the 7 days of the survey separately, the results are presented, on an hourly basis, in the matrices of the annexed sheets "i" for each day of the survey period.
7. Table 1 below shows the contribution of individual OD-cells to the generation of through traffic in Port Louis. It is obvious that, for instance, trips between Grand Port (cell #5) and Flacq (cell #4) do take place in the east of the island and do not charge any roads near or within Port Louis. Conditions are less clear for the relation between Savanne and Pamplemousses or between Moka, that are likely to charge some of their origin-destination traffic on Port Louis, but not all of it. The assumption, in these cases, is that 50 % of the total volumes is choosing a route via Port Louis. This is further explained as:

Traffic going into Port Louis has partly to be considered as origin or destination traffic and partly as through traffic for the major north-south links, namely along the waterfront. For instance, a vehicle coming from Quatre Bornes and going to the Central Business District has its destination there and, strictly speaking, does not represent through traffic. A vehicle coming from one of the southern quarters of the capital and going to Grand Bay does represent through traffic since it will be using one of the available south-north road links, namely between the city centre and the harbour. The assumption is that in this sense one half of the vehicles coming from the south and going to Port Louis have to be considered as through traffic (which is here taking into account the traffic passing through the peak hourly locked junctions, viz. Caudan round-about, Places D'Armes junction). The same applies to vehicles coming from the north (here traffic passing through Quay-D round-about and Places D'Armes junction) and as well to all vehicles leaving the capital, regardless whether northbound or southbound. Therefore, the contribution of each of the traffic zones to the generation of this typical through traffic in the central part of Port Louis has to be assessed individually. The respective assumptions are shown in table 1 below.

However, it is to be added that the actual true through-traffic flow is that which has its trip without interfering with any internal traffic of Port-Louis. This has also been accounted for in the next section so that this school of thought is retained too, as a matter of comparison.

Table 1: Contribution of individual origin-destination zones to the generation of through traffic in the central part of Port-Louis

origin		destination								
name	code	1	2	3	4	5	6	7	8	9
Port Louis	1	50%	50%	50%	50%	50%	50%	50%	50%	50%
Pamplemousses	2	50%					full	full	full	full
Riviere du Rempart	3	50%						full	full	full
Flacq	4	50%								
Grand Port	5	50%								
Savanne	6	50%	full							
Black River	7	50%	full	50%						
Plaine Wilhems	8	50%	full	50%						
Moka	9	50%	full	50%						

no contribution	50 % contribution
full contribution	

8. Multiplying the values of the matrices showing total origin-destination volumes between all traffic cells ("i"-tables, as explained under 6) with the through traffic contribution factors of the table above results in traffic volumes representing the total through traffic across Port Louis. For the 5 working days covered by the survey period the summed up weekday values have been determined. These are, on an hourly basis, presented in the annexed tables "j". Saturday and Sunday values are shown separately.

9. Finally, the volumes of through traffic as determined under indenture 7 and shown in the tables "j" are shown in the maps "k" and "l" separately for traffic going into or coming from Port Louis and for traffic between the other contributing cells. The corresponding Sunday values are shown in the maps "m" and "n".

Note: "going to" and "coming from" means that these trips have their destination or origin in such quarters of Port Louis that make them represent through traffic in the sense of this investigation. See relevant explanations under indenture 7 above.

4.3 Assessment of Results

Table 2 below shows the overall result of the survey regarding through traffic in Port Louis, as factored from table 1 above. It shows the contribution of the districts to creating through traffic, and it shows how much Port Louis itself is contributing to creating "semi"-through traffic. This due to the fact that trips from the south having their destination in northern quarters and vice-versa represent through traffic along the waterfront or other major north-south links, as far as available. In essence, the total OD trips from this methodology equates the total trips to and from Port-Louis, including the full contributory through traffic, neither entering nor leaving the capital. Table 3 shows this distinction. This information is in line with that through traffic required as per the ToR.

Table 2: daily volumes of overall through traffic (PCU) from sum of all survey locations, average of 5 weekdays

time interval:	6:00 - 18:00											
origin		destination										
name	code	1	2	3	4	5	6	7	8	9	sum OD	
Port Louis	1	4338	5677	802	646	414	278	1197	4262	1692	19306	
Pamplemousses	2	8894	0	0	0	0	219	2910	12530	3824	28377	
Riviere du Rempart	3	4145	0	0	0	0	0	1095	3748	511	9499	
Flacq	4	1103	0	0	0	0	0	0	0	0	1103	
Grand Port	5	706	0	0	0	0	0	0	0	0	706	
Savanne	6	389	223	0	0	0	0	0	0	0	613	
Black River	7	2229	1698	479	0	0	0	0	0	0	4406	
Plaine Wilhems	8	8834	7827	2529	0	0	0	0	0	0	19190	
Moka	9	3699	3989	650	0	0	0	0	0	0	8338	
sum OD		34338	19415	4460	646	414	498	5202	20539	6027	91538	

Table 3: daily volumes of full contributory through traffic (PCU) from sum of all survey locations, average of 5 weekdays

time interval:	6:00 - 18:00											
origin		destination										
name	code	1	2	3	4	5	6	7	8	9	sum OD	
Port Louis	1	0	0	0	0	0	0	0	0	0	0	
Pamplemousses	2	0	0	0	0	0	219	2910	12530	3824	19483	
Riviere du Rempart	3	0	0	0	0	0	0	1095	3748	511	5354	
Flacq	4	0	0	0	0	0	0	0	0	0	0	
Grand Port	5	0	0	0	0	0	0	0	0	0	0	
Savanne	6	0	223	0	0	0	0	0	0	0	223	
Black River	7	0	1698	479	0	0	0	0	0	0	2177	
Plaine Wilhems	8	0	7827	2529	0	0	0	0	0	0	10356	
Moka	9	0	3989	650	0	0	0	0	0	0	4639	
sum OD		0	13738	3658	0	0	219	4005	16278	4335	42232	

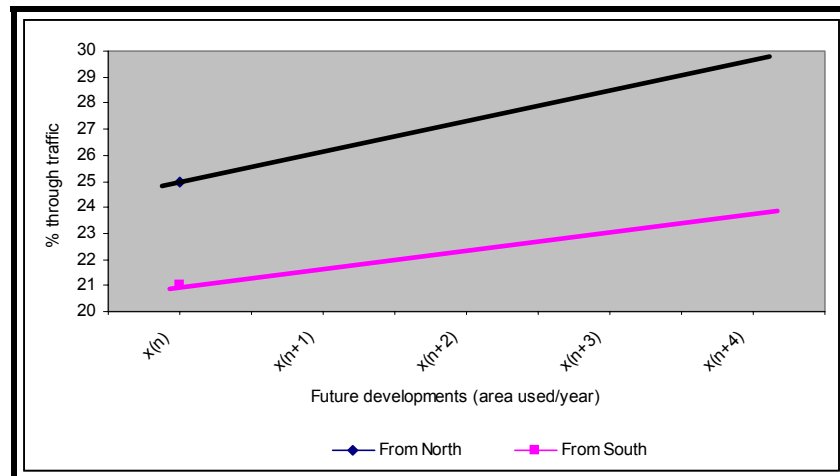
The full contributory through traffic which completely by-pass Port-Louis accounted to 42,232 trips. This represents an aggregated 46% through traffic, passing daily over Port-Louis from the North to the South and vice versa. It is to be noted that the present North-bound traffic and South-bound traffic moving in the direction of Port-Louis are counterweighed about the Port-Louis fulcrum on an average daily basis. This is not surprising and can be explained by the corresponding pace to which recent and on-going developments in the Northern areas have emerged with accompanying necessity for traffic to connect to the South along the only corridor which passes through Port-Louis. The Southern areas are also replicates to such similar North-bound necessities. To determine the percentages of through traffic generated from the North and from the South respectively, a balancing ratio has been determined. The summarized working methodology is shown in Table 4 below.

Table 4: Calculation of the percentages of through traffic generated from the North and the South respectively

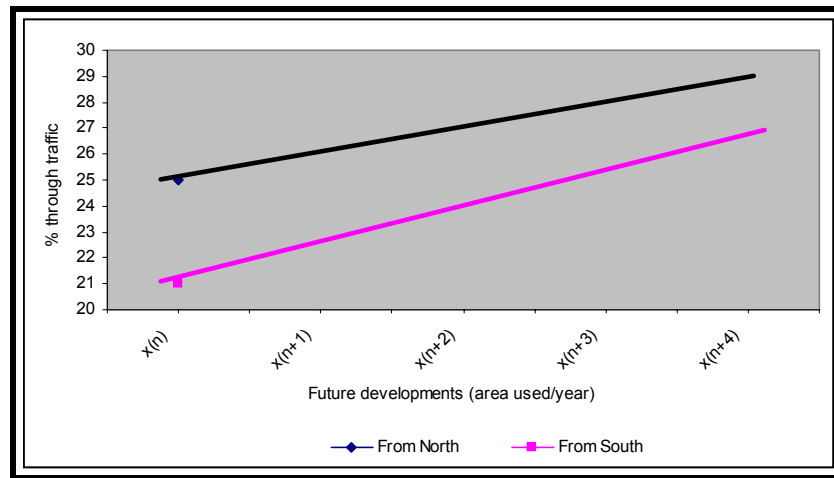
		Towards Port-Louis Total average daily traffic (pcus)	Total traffic generation (pcus)	Balancing Ratio	Through-traffic ratio (%)
From Northern area	Pamplemousses	28,377	38,979	1.2	25
	Riviere du Rempart	9,499			
	Flacq	1,103			
From Southern area	Grand Port	706	33,253	1	21
	Savanne	613			
	Black River	4,406			
	Plaines Wilhems	19,190			
	Moka	8,338			
	TOTAL	72,232			

The rationale to determine the through traffic generated from the opposite directions follows from the fact that the through traffic is included within the daily traffic density towards Port-Louis. It is difficult to extract this traffic of interest as drivers could change routes at any given time, passed the interview stations. To compensate for such behaviours, though considered negligible on a macro-level, the average daily traffic moving towards Port-Louis has been parted and summed according to generated traffic from the Northern areas and the Southern areas respectively. The ratio has been worked out and is a 1:1.2 South-North one. This ratio has been applied to the total through traffic of 46%. The outcome boils to **21% through traffic generated from the Southern areas and 25% from the Northern areas on an average daily basis.**

These figures are bound to increase in coming years with major projects in the Southern and Northern parts of Port-Louis. As a rolling illustration, the theoretical relations which exist between future developments and the corresponding through traffic trips generations can best be appreciated through the following graphs:



Graph 1: Future developments accentuated in the Northern parts of Port-Louis



Graph 2: Future developments accentuated in the Southern parts of Port-Louis

Graph 1 shows a diverging relationship between the through traffic from the South and that from the North as developments in the South increase over 4 years, reaching the threshold of 30% South-moving through traffic with a net increase of some 5% over that period of time. The through traffic to be generated from the South towards Port-Louis gains a 3% increase only.

Graph 2 considers an increase in future developments in the Northern areas of Port-Louis. In this case, the through traffic to be generated from the South towards Port-Louis increases by some 5% over a 4 years' period. The through traffic from the North generates an additional 4% such trips over this same period.

It is to be noted that the rate of increase of the through traffic from both graphs 1 and 2 has been taken from a 4% annual rise in the fleet of vehicles. It is quite realistic to make this assumption as the through traffic form part of the daily average road traffic demands. As can be clearly deduced, over a period of 4 years, the traffic situation will be chaotic to such an extent that immediate measures should be taken to at least counteract the effects of the through traffic. Developments in the Southern and Northern areas will have to continue, but at compatible rates for demands from through traffic. The work-oriented trips into Port-Louis cannot be disregarded from such a statement as those trips are also subsets of the same demands. From the survey, 43% work-based trips out of an average daily interview carried out from all stations are attracted within Port-Louis. This is bound to increase over years to come.

As such, future investigations should focus on gaining more detailed information on the internal distribution of trip origins and destinations within the city boundaries. Therefore, the urban area should be subdivided into cells and interviews should include related detailed questioning in the case that "Port Louis" is indicated as origin or destination of a trip.

5 RECOMMENDATIONS

From the findings of this study, it can now be quantifiably said that 46 % from the total average daily traffic pass through Port-Louis, thereby contributing as an additional traffic load onto the main entrances and exits of the Capital. It should be stressed here that this study was carried out during school holidays, with the traffic density levelled on a manageable scale. Still, this figure of 46% should be appreciated as being on a high side if compared to the sustainable hourly capacities of the Caudan round-about, Places D'Armes junction and the Quay-D round-about – 25% through traffic generated from the North and 21% from the South respectively. This 46% through traffic should be expected to increase in coming years and it should be immediately dealt with so that chaotic congested traffic situations could be escaped. No restraining measures would ever remove this through traffic from the roads leading towards Port-Louis. The shortest distance and trip purpose are critically the guiding traffic philosophy for such movements. The only way out would be to give an alternative to those road users, pending long term measures of economic scales. A ring road that provides several accesses to the city would, in addition, attract many of the city-related (origin and destination) trips that are at present loading the waterfront road, and also some of the internal trips between remote quarters of the capital. Additionally, the debate opens onto whether the impacts of the 25% through traffic coming from the North or those from the 21% coming from the South could be counteracted separately so as to relax present and future traffic delays. The option to decentralize service-providing departments from main offices should squeeze the forecast climbing 43% work-based trips. Both the public and private sectors should be encouraged to contribute towards this end.