

Preparatory Activities/Detailed Studies for the Integrated National Transport Strategy

MULTI-CRITERIA ANALYSIS  
OF THE  
ALTERNATIVE MODE OF TRANSPORT

EXECUTIVE SUMMARY

Mauritius

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## **Purpose of the Study**

The Ministry of Economic Development, Financial Services & Corporate Affairs, with the assistance of the Japanese Government and the World Bank, commissioned Halcrow Fox to undertake an Integrated National Transport Strategy Study (INTSS) for Mauritius. The study, which was carried out between January 2000 and July 2000, addressed among other things the effect of increasing congestion on the Curepipe – Port Louis corridor. A supplementary study was undertaken in early 2001 by the same firm to re-examine the choice between the Alternative Modes of Transport (AMT) - guided or unguided busway or a light railway.

Following discussion with the World Bank, it was agreed that, prior to a final decision on the choice of the technical option, there was a need to carry out further in-depth studies relating to both options so as to help Government make the most appropriate choice, taking into account the long-term sustainability and affordability.

The principal objective of this study was:

*To undertake a multi-criteria analysis that meets the requirements of the World Bank and enables the Government of Mauritius to make an informed, rational decision on the option to be adopted for the AMT.*

Multi-criteria analysis (MCA) is a technique for evaluating options where the choice can impact on a number of issues of concern to the government, and one option is not a clear winner under all the issues. MCA usually involves the following steps

- Identification of the options available to the Government (including identification of a “do minimum” option);
- Identification of the issues (goals) that would be affected by the selection of a preferred option;
- Expressing the goals in the form of objectives that are measurable (either objectively or subjectively);
- Estimating the likely performance or subjectively scoring each of the options under each of the objectives; and
- Subjectively weighting the scores under each objective to enable an overall total score to be calculated.

The approach adopted was to undertake the above steps with the assistance of stakeholders by organising workshops where the options, objectives, scores and weights could be discussed. The output of the process will be a decision matrix or “planning balance sheet” that can be presented to the Government along with the weightings developed at the workshops.

The process was designed to allow guidance to the Government’s decision to be given based on local values and assessments. The Government of Mauritius (GoM) will be able to test the underlying assumptions, and use the totality of the data to make an informed decision on the AMT issue.

## **The Problem**

The decision facing the government of Mauritius is how to respond to increasing motorisation consequent upon a rising standard of living. Mauritius is facing a familiar pattern of decreasing public transport use, increasing car ownership and increasing congestion on the roads.

Motorisation per se is not a problem. It gives individuals a huge increase in personal freedom and ease of movement. It is the impact of motorisation on the realisation of transport objectives that is a concern. This section considers the “do nothing” situation. The headings are the issues under which the objectives in the MCA were grouped.

### **Economic**

The main direct impacts of are economic. Congestion increases personal travel time and the time for transport of goods. It has an impact on the vehicle capital stock (eg the number of buses required to service the conurbation) and vehicle operating costs. One estimate puts the cost of congestion at Rs 1.2 billion per year. Motorisation has a perverse effect on remaining public transport passengers. As patronage falls, services are reduced so those left behind suffer a less frequent and often more expensive services.

### **Financial**

The distinction between financial and economic is rather fine, but the concern here is primarily the budgetary impact. The financial position of the Government of Mauritius is not robust, so major expenditures could create some strain financially. Increasing motorisation brings with it a demand for increased road space. In urban areas this can only be provided at great cost.

### **Safety**

Accident rates for car drivers and passengers are significantly higher than those for public transport passengers; so increased motorisation creates a challenge in this area. The impact is often greater on pedestrians than motorists as traffic and vehicle speeds increase on roads where use has traditionally been mixed and there are no footpaths.

The impact of congestion is to slow traffic, so although the incidence of non-injury accidents (slow speed nose-to-tail being the most common) may be high, safety is less of an issue than might be expected in congested conditions.

### **Social**

Expenditure to address congestion is regressive: that is, it redirects money towards projects that benefit the better off in society. Public transport has deteriorated as passengers have abandoned public transport for private modes of transport. The people left are often on concession fares so there is a further adverse impact on the viability of the services. Even spending on the AMT, which will provide better services for the less advantaged, will only be judged a success if it attracts (ie is of benefit to) current car users.

### **Environment**

Slow moving or idling vehicles run less efficiently and for longer than vehicles travelling in uncongested conditions. This increases potential health problems and could detract from the image Mauritius wishes to portray as a tourist destination and a financial centre.

## **The Options**

Increasing motorisation is inevitable, but the speed and impact of the change is not. Unless action is taken, the side effects will get worse. A range of actions is possible.

### **Build More Roads**

Congestion occurs because the demand for road space exceeds the supply. One response is to build more roads. Unfortunately, the number and the cost of the roads that would be needed to eliminate congestion is prohibitive. Peak road space costs more to provide than users pay.

### **Improve Bus Services**

The conventional “low cost” approach to congestion relief is to provide selected bus priority. It is often justified as a carrot and stick approach – bus services get priority partly at the expense of the other traffic. It has little impact on congestion.

### **An Alternative Mode of Transport**

The AMT uses the former rail right of way to provide a more attractive public transport service. Halcrow reduced the options to two main contenders:

- A kerb guided busway (KGB)
- A Light Rail Transit system (LRT)

### **Car parking and other traffic restraint measures**

As pointed out in previous studies, some form of traffic restraint is needed for the AMT to work. Parking measures create a conflict of objectives between the municipality – which wants to provide more parking to attract businesses and consumers – and the road authority, which wants the supply restricted to reduce road costs. Port Louis is ideally situated for the original Singapore-style electronic road pricing (ERP) scheme which levied charges on entry to the central business district.

## **The Multi-Criteria Analysis**

The choice between the AMT options was the subject of a half-day workshop attended by participants from a number of stakeholder groups. The workshop was in two sessions.

In the first session, the groups were asked to score the two options against a list of some 20 objectives. Participants were asked to consider the impact of adopting either option on the achievement of each of the objectives.

The second session involved placing weights on the objectives. Each group was asked to allocate a total score of 100 across the 20 objectives reflecting the importance of the objective. There was no limit placed on the number of points to be allocated in any issue area. An analysis of the weights showed that by and large the participants valued the impacts in a sensible and internally consistent manner.

A planning balance sheet comparing the options is presented on the following pages. It shows, for each objective, the performance of the options. For objectives where numbers are not available, the impact is scored subjectively.

On balance the analysis favours LRT by 50 points to 45. The guided busway is the most cost effective transport solution, but the LRT scores more points on environmental and other wider issues. However the differences are small and the result is sensitive to the weighting of the objectives. Relatively small changes in the weights change the order.

The weights show how important each objective is to the stakeholders that were present at the workshop. They are in no way “binding” on the government but provide a starting point for debate. The largest block of stakeholders – the travelling public might place greater weight on user benefits.

## Conclusions

On balance, the LRT scores best in the multi-criteria analysis. However the answer given by the analysis depends on the question.

- If the question is, “which system would provide the best value for money” the answer, based on the weightings indicated by the workshop<sup>1</sup>, is “the KGB”. But, neither an LRT nor a KGB will provide a solution to the congestion problem on their own.
- If the question is “what is the best system to address congestion?” the answer is “an LRT complementing a electronic road pricing regime”. While public transport users wouldn’t care too much whether they were travelling in an LRT or on a busway, car users will rate LRT services higher than bus services. A car user is more likely to think that he has a real choice with an LRT even if he continues to use his car.

The real question, as pointed out in all previous studies is “how committed is the government to addressing congestion?”

Increasing congestion is an economic problem. Peak road space is underpriced.

- Building more underpriced road space is popular with the public but is hugely expensive and ultimately self-defeating.
- Providing underpriced public transport as an alternative is costly and ineffective.
- Parking restrictions and traffic restraints are unpopular with the public, difficult to enforce and are ultimately ineffective. In fact restrictions on the use of the car impose more costs than they avoid.

What is needed is an economic solution – to price scarce road space using ERP.

It makes sense to link ERP with the construction of an LRT. The revenue from ERP can be used to fund the government contribution to the initial cost of the LRT. It is therefore possible to envisage a self-funding package that consists of:

- Electronic road pricing for Port Louis and the conurbation;
- The LRT built, partly financed and operated without subsidy by a concession;
- Commercial bus services supplementing the LRT;
- Parking policies in Port Louis that provide for people coming to the city;
- Traffic moving under optimum flow conditions (averaging about 40 km /h).

Feasibility studies (with appropriate check points) for this package should start now.

**A package consisting of electronic road pricing and a light rail transit system would together provide an effective solution to congestion in the Curepipe-Port Louis corridor.**

**Light rail will not reduce congestion by itself. If the Government does not consider the congestion problem sufficiently serious to require road pricing, it should not be considering either of the AMT options.**

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<sup>1</sup> The GoM will wish to (and should) review the weightings given by the workshop participants.

## PLANNING BALANCE SHEET

Objectives	Measure	Comment	Kerb-guided busway (KGB)	Light rail transit (LRT)	Balance	Points
<b>Economic</b>						
Resource cost	Initial Cost		Rs 4.300 million	Rs 6.200 million	<b>Favours KGB</b>	<b>12 (6 per billion)</b>
User benefit	Benefits to PT and Car		Rs 11.400 million	Rs 12.100 million	<b>Favours LRT</b>	<b>13 (20 per billion)</b>
Non-user cost	Delays/ diversion for pedestrians	Some crossings closed	Probably able to provide more crossings	Access to cross tracks restricted	<b>Favours KGB</b>	<b>5</b>
National impacts	Image of Mauritius / multiplier effect	Effect on wider economy, role of Mauritius.		Thought to present a more modern, positive image	<b>Favours LRT</b>	<b>9</b>
<b>Financial</b>						
Financial sustainability	Net operating surplus	Excludes capital repayments etc.	Rs 200 M per year (PV 2.000 M)	Rs 190 M per year (PV 1.900 M)	<b>Favours KGB</b>	<b>4 (40 per billion)</b>
Affordability	Fare	Policy decision, not feature of mode	Figures based on an average fare of Rs 12	Figures based on an average fare of Rs 13.2	<b>Favours KGB</b>	<b>7 (6 per rupee)</b>
Financial risk	Interest premium	Reflects probability revenue will be achieved, costs will be controlled	Operating costs and revenues for bus system well understood.	Greater transfer of passengers Requires complementary strategies	<b>Favours KGB</b>	<b>6</b>
System failure risk	Percent of system proven	Reflects concern about adopting “unproven” systems	Very few guided busways-this will be longest in world	Rail systems common in developed countries	<b>Favours LRT</b>	<b>7</b>
<b>Safety</b>						
PT users	Injuries to passengers	Both relatively closed systems so safety can be controlled	Should be very safe	Rail systems generally have higher safety standards. Individual events are more catastrophic	<b>Favours LRT</b>	<b>6</b>
Pedestrians	Injuries caused by vehicles	Both relatively closed systems so safety can be controlled	. Grade separation at major intersections	. Grade separation at major intersections	No preference	<b>3</b>

## Social

Job dislocation	Jobs adversely affected	The number of new jobs depends on type of ticketing etc.	Net loss of 200 jobs (includes new jobs on feeder buses) Some felt this figure understated.	Net loss of 300 jobs (includes new jobs on feeder buses) Some felt this figure understated.	<b>Favours KGB</b>	<b>6 per 100 jobs</b>
Displacement	Houses displaced	Depends on route selected.	Expected to be the same in each case	Expected to be the same in each case	No preference	2
Improved opportunities	Travel time to schools, employment, etc		Significant improvement especially for public transport passengers	Expected to be better than busway	<b>Favours LRT</b>	<b>4</b>
Alienation	Community severance	Right of way divides some existing communities	May be easier to provide crossings		<b>Favours KGB</b>	<b>2</b>

## Environment

Development strategy	Consistency with strategy	Strategy to discourage growth outside the corridor.		LRT seen as a clear commitment to the corridor strategy	<b>Favours LRT</b>	<b>2</b>
Resilience to natural disasters	Probability of loss * cost	Mainly the impact of cyclones	Buses can divert around damaged sections		<b>Favours KGB</b>	<b>3</b>
Impact on environment	Subjective assessment	Includes noise, visual intrusion, etc.		LRT perceived as more environmentally friendly	<b>Favours LRT</b>	<b>3</b>
Noxious emissions	Tonnes SO <sub>2</sub> ,NO <sub>x</sub> etc.		May be possible to import cleaner fuels	Remote power station enables better control	<b>Favours LRT</b>	<b>4</b>
Greenhouse Gases	Tonnes CO <sub>2</sub>	Not a Mauritius problem		Electric traction less efficient conversion	<b>Favours KGB</b>	<b>0</b>
Sustainability	% fuel supplied from local source.			Electricity from bagasse	<b>Favours LRT</b>	<b>2</b>

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