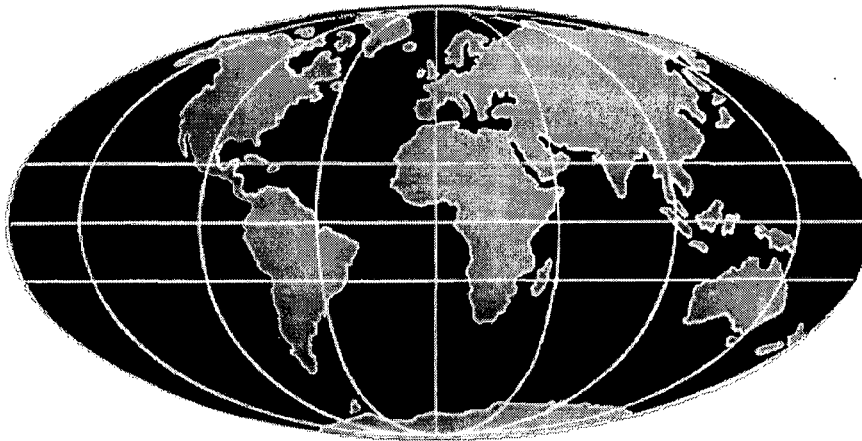


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# MASS TRANSIT DECISION MAKING

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## 1 INTRODUCTION

Recent work by the Overseas Centre of the Transport Research Laboratory (Fouracre et al 1990, Gardner et al 1991, 1994) has shown that some aid-supported investment decisions made in developing city transport projects appear to be unusual. This contradicts the aims of the international aid agencies who predominantly have clear statements about the conditions of their aid funding based upon rationality.

This paper examines the particular case of mass transit projects, since these are amongst the largest investments any city can make. The paper first examines the technical case for the main choice options, and then comments upon other factors which may influence the decisions made.

## 2 MASS TRANSIT

The term mass transit as used here refers to any urban transport system carrying large volumes of people, usually along well-defined corridors connecting suburbs to city-centre. This paper focuses on those mass transit systems that commonly use a reserved right-of-way for some, or all, of their route length, this includes:

**Metro:** A metro is often referred to as an underground railway, but can be any grade-separated urban railway. The track and electric vehicles are similar to suburban railways, though with closer station spacing. Metro trains may have 6-8 cars, with a total capacity of up to 3,000 passengers.

**Busways and bus lanes:** Both include right-of-way for the exclusive use of buses, segregated by lines or by physical means. Busway transit would include additional features like well-designed bus stops, special operating methods (bus convoys or express operations), efficient fare collection methods, and clearly defined routes with names like 'green line' or 'circle line'. Busways have good carrying capacity, have flexibility and are cheap to install, but still suffer from a poor image;

**Light Rapid Transit (LRT),** thought by many to offer an intermediate solution: with lower costs than a metro, but with a better image than a busway. Some systems, including those of Manila and Istanbul, use exclusive track and high platforms similar to a metro. Other systems have at-grade crossings and low level platforms. LRT trains may be made up of two or three cars, with a total capacity of up to 750 passengers. Trams are a basic form of LRT that have limited rights of way, sharing roadspace for much (if not all) of their route length with ordinary traffic. Tram cars are likely to have lower capacity than LRT cars, and are usually operated singly or in pairs.

## 3 PERFORMANCE INDICATORS

There are many popular misconceptions about the relative performance and costs of the three main mass transit options. For the purposes of this paper, the options will be compared primarily by capital cost and capacity. More detailed comparisons are given in Gardner (1994).

### 3.1 COSTS

Out-turn cost data vary according to design standards, local construction procedures, exchange rate variations, and so on. The overall capital costs for a complete system are estimated in Table 1. The more grade-separation, tunnelling, use of heavy rolling stock and sophisticated control equipment, the higher the cost.

**Table 1. Capital costs of mass transit schemes: costs in US\$ millions (1993 prices)**

	<i>Bus lane</i>	<i>Busway transit</i>	<i>Tram</i>	<i>LRT</i>	<i>Metro</i>
<i>Capital cost per route km.</i>	<i>&lt; 0.5</i>	<i>2.0-10.0</i>	<i>5.0-15.0</i>	<i>10.0-30.0</i>	<i>40-90.0</i>

*Note: includes rolling stock, except in case of bus lanes*

There is little doubt, then, that a metro is an order of magnitude more expensive than a busway. A new scheme involving underground construction could easily exceed one billion US dollars. At such prices city (and even national) economies can be affected.

Operating costs per passenger kilometre are similar for buses and light rail. Given that capital costs can equal operating costs over the lifetime of a rail project, it is clear that operating cost alone is not a good indicator of the price a city will pay.

Very few public-sector bus or rail services, if any, are able to rely entirely on direct revenue. Very different results can be achieved from LRT and Metros according to the income of passengers, population density, and depending on the political decision of whether to maximise occupancy or minimise subsidies. Hong Kong, which is a very special case, has a farebox/operating cost ratio of 2.2, but two-thirds of the metros studied by Fouracre et al. (1990) required operating subsidy.

### 3.2 CAPACITIES & SPEEDS

The TRL research placed a high priority on fieldwork at the site of mass transit systems in order to judge the actual capacities, and the factors which influence it. The results are shown in fig 1. It is clear that the two largest cities of the World; Mexico City and Sao Paulo; and the highly densely populated Hong Kong, have conditions producing flows only a metro could carry. For many other cities, however, and for the secondary corridors on the largest cities, alternatives are available.

TRL findings have questioned the generally accepted idea that LRT has a higher capacity than busways. In fact the opposite appears to be true. Even the Manila LRT (with full segregation and with near-saturated demand) has passenger flows less than several busways. (Gardner et al. 1994).

An important consideration for an operator is the commercial speed. That is the average speed that can be achieved when allowance is made for passenger boarding, time at termini and for traffic control. TRL field surveys reveal little difference between the busway and LRT modes, and analysis using multiple regression techniques to allow for factors such as station spacing, suggests that the inherent difference between busways and LRT is not statistically significant.

The evidence suggests therefore that there is little justification for spending up to \$90Million per kilometre for a system that might carry the same number of passengers as one costing just \$5Million per kilometre. Clearly other factors are influencing the decisions that are made.

## 4 DECISION MAKING

The choice of a mass transit system is made according to many factors. These can be divided into two main categories; the first of these include 'practical' issues, such as performance indicators described above. The second category includes institutional and 'political' issues. Political effects, for example 'civic pride' can be beneficial or damaging, and appear to play a major part in influencing choice. Mostly these effects will be difficult to quantify objectively, especially in financial terms. In some cases, they may be not just unquantifiable, but intangible.

For the purposes of this research, a broad categorisation of the reasons why a decision might appear 'unusual' to Western observers has been made, as follows;

### 4.1 THE EVALUATION PROCESS

One of the reasons for differences in opinion between funders and recipients might be because of the evaluation process itself: either because the method used is flawed, or because insufficient information is considered by it.

Most lending agencies and development banks have to produce audited accounts and must use methods that are open to scrutiny and objective validation. Methods that examine real costs and benefits do have the advantage of transparency and replicability by independent auditors. Cost-benefit analysis is a broad term covering the analysis that compares the costs and benefits of a particular action.

Social cost-benefit analysis attempts to quantify all of the benefits of a project. There are many inputs to this process, and some disagreement exists over what should be included. One of the largest inputs is the value of the time saved as a result of the new investment.

Value of time is a concept that is difficult to quantify accurately, and yet it is a key to the economic feasibility of most transport schemes. Some have questioned the basic philosophy of costing a large number of small time savings made by poor people in a developing country (Stopher, 1980).

One of the most vigorous critics of Cost Benefit Analysis (COBA) has been Dr John Adams, from University college London. According to him;

"Cost benefit analysis is a nonsense. It stands even less chance of reducing the basic elements of transport planning decisions to gold than did the rituals of the medieval alchemists who attempted to perform a similar feat with rather more tangible base elements.... Science has been called the art of the soluble; COBA is one of the black arts of the insoluble." (Adams, 1981)

Even in the official literature, there is growing awareness of the shortcomings of using cost benefit analysis alone to evaluate aid projects. An environmental appraisal and a social impact audit are now required by the UK Department for International Development, DfID (formerly Overseas Development Administration, ODA) and the World Bank (ODA, 1993).

#### **Inputs to evaluation**

For the full benefits of a scheme to be assessed, every possible benefit and disbenefit should be considered. There are factors that are usually considered impossible to quantify. These are the intangible benefits.

Some intangible elements associated with a project may be positive, for example where the project acts as a catalyst for other beneficial things. If not accounted for, a project that could bring real benefits to a city might be rejected because its benefits are not considered.

As an example of intangible benefits, Lord Beswick, head of British Aerospace stated (when discussing Concorde) "There is a psychological spin off, a constructive feeling of pride, a stimulating sense of prestige, if one's own society can claim to lead in any given field" (Adams, 1981). Another very large intangible benefit might be that a mass transit system can sustain the essence of a city centre - as the most accessible point from both within and without the city. This superior accessibility is important for many activities, and in particular for those central functions that serve a wide area and/or need a wide labour market.

Some efforts should be made to ensure that all possible benefits and disbenefits are considered fairly. However, promises of intangible benefits should not be used to support projects which could be seriously detrimental to a city.

## **4.2 INSTITUTIONAL CAPACITY AND KNOWLEDGE**

### **Unforeseen Circumstances**

Many of the World's metros have been built despite a catalogue of disastrous events that beset them. These include natural catastrophes such as rockfalls, floods; personnel issues and strikes, financial problems, and almost every other type of difficulty.

The extent to which these should have been predicted is debatable. Fouracre et al (1990) found that on average Metro capital costs were underestimated by 100% whereas patronage was overestimated by 100%. This would seem to suggest that forecasts have been particularly optimistic.

### **Information availability**

The research described here represents one of the first known examples of a comparison of modes using actual survey data from developing cities. There is still no universally accepted means of quantifying the benefits due to time savings with any kind of precision. Despite these substantial gaps in current knowledge, there is no shortage of advice, either commissioned or unwanted, regarding the merits of mass transit.

It is the exception, rather than the rule, for politicians to be technical experts in the field of transport and engineering. The quality of decision made, therefore, can depend upon the quality of information and advice that is available to them. This information can come from specially commissioned studies, technical literature and manufacturers' publicity.

The over-optimistic forecasts referred to above have brought no reported recrimination on those who prepared the initial 'feasibility' studies. Manufacturers, clearly, have an interest in presenting their products in the best possible light. It is surprising, however, the extent to which mis-information is presented by others as if it were

documented proof. For example a report to the UK Parliament Select Committee on Transport, by the Manchester City Transport Authority stated.

"Light rail has a higher capacity and speed than the bus...It is also more environmentally friendly with no polluting emissions and low noise levels" (HMSO, 1991)

In fact LRT has no emissions at street-level, but is rarely without pollution at the point of power generation.

### **Organisational Structure**

The capability of countries to organise, integrate and implement any infrastructure project is dependent on the institutional structures in place and their level of accountability for the goals or objectives. Mass transit activities are usually the responsibility of several different government agencies and private bodies. One strong organisation is required to draw up the plan and ensure that all the participating agencies procure the necessary funds and implement their part of the programme.

Earlier research (Gardner et al, 1990) found that institutional problems were by far the greatest obstacle to successful implementation of transport projects in the Third World. It is a difficult subject to research, and in which to make improvements. However, in recognition of the problem the UK Department for International Development (DfID) has designated "Good Government" as one of its priority areas for the 1990s (ODA, 1993b). Careful descriptions of the problem such as those by Barrett (1984) and Allport (1988) can help. One of the aims of the present research is to contribute to the understanding of the issues, and to develop a methodology to ensure all major items are considered fairly.

## **4.3 POLITICAL FACTORS**

It is difficult for an aid agency or its advisors in one country to make judgements about the politics of another nation. What might appear to be an incorrect decision might in fact be local politicians correctly representing the view of their people in supporting a project not normally considered optimal by Western standards.

### **Good Government**

In the official UK Department for International Development aid manual, some attempt has been made to define what is meant by 'good government' ; There are three elements to Good Government:-

- Competent management of the economy, including efficiency, transparency and accountability.
- Democracy, pluralism and participation.
- Respect for human rights and the rule of law. (ODA, 1995)

It follows from this definition that a 'good' decision would reflect these values. In practice, almost every system has its own peculiar factors that have influenced implementation and it is difficult to generalise on the relative influence of what often appear to be peculiar and random events. In Prague, for example, the city's underground metro was built during the 'Cold War', and following the Soviet invasion of the city. Some of these unpredictable influences may prove, with the passage of time, to be fortuitous: others have resulted in financial and economic hardship.

If one accepts that the sign of a good society is one in which decisions are taken for the benefit of the maximum number of people, then the benefits of public investment should be evenly distributed. In this respect, any public transport system *should* score highly, as it can bring widespread benefits. The problem occurs when the extremely large amounts of money involved are not spent wisely. Another difficult balance can be the excusable desire to obtain the maximum benefit for an electoral constituency versus what is best

for the nation as a whole. This is reported to cause disenchantment in some countries, where the regions complain about the dominance of the capital city.

Less excusable is the influence of non-altruistic decision making. There are many pressures on political leaders, not least in developing countries, to choose a particular mass transit option. The status or image benefits that a modern transit system can bring to a city appear to have a significant part to play in the decision making process. Furthermore, in some societies where "commissions" and informal payments can add around 10 percent to a project cost, the attractions of a billion-dollar metro are obvious. In Italy, the former prime minister Craxi has been accused of accepting payments in connection with the building of Milan's underground railway. (Hooper, 1994) It is not yet known whether such payments influence the choice of system, or simply add to the costs of the preferred option.

The political desire to 'do something' to build a city's image, bolster support, or to reward past favours may also influence the choice of system. This would favour prestige projects such as modern rail systems, even when these might not be the best practical or cost-effective solution.

### **Global and National Politics**

In order to understand better the current situation, it is helpful to look at the most important historical influences on developing countries.

The majority of the World's developing countries have at some time during their past, been under colonial rule. The legacy of this has varied according to characteristics of the two parties. Although colonial rule mainly came to an end during the 1950s-1970s, there is an ambiguity in the definition of decolonization. As Krieger, et al (1993) points out "Simply because a country is nominally independent does not mean that it is immune to foreign influence - at times to such an extent that it is part of an informal empire". For example, although nominally sovereign states, the countries of the Warsaw Pact were very highly dependent on rule from Moscow. El Salvador would not easily have survived during the 1980s without US assistance.

Following the Egypt-Israel war in 1973 oil prices quadrupled as the non oil-producing Less Developed Countries' current account deficit rose from \$8.7bn in 1973 to \$51.3bn in 1975. Conversely, the OPEC countries' current account surplus rose from \$6.2bn to \$66.7bn in 1974. Unable to spend this surplus, the OPEC countries invested on the US and London money markets.

"The view prevalent among the international banking community that Latin America was set for high rates of economic growth led to a 'recycling' of the petro dollars in the form of massive lending to LDCs". (Pilbeam, 1992).

Borrowing by LDCs helped them to avoid politically unpopular International Monetary Fund restructuring, and to continue to fund inefficient state enterprises, maintain artificially high consumption levels, and to construct prestigious projects (including metros).

## **5 DISCUSSION & CONCLUSIONS**

Although a decision about a mass transit system may appear to be taking place at the local level, and based upon objective criteria, this might be only half of the story. The actual decision may be strongly influenced by a mixture of forces, some far beyond the control of individuals or even countries.



The factors that can influence the decision made regarding a large infrastructure project are many and varied. Some form of categorisation of these has been attempted in this research. The reasons why a decision might appear to Western observers to be 'wrong' might be summarised as follows;

**The Evaluation Process:**

- \* There is a difference in opinion between recipients and Western agencies regarding the method of evaluation used (for example in the acceptability of cost-benefit analysis).
- \* There are real benefits to the people which are not properly quantified in the evaluation process.

**Institutional Capacity and Knowledge:**

- \* A correctly planned project becomes a 'failure' due to problems that genuinely could not have been foreseen.
- \* Political leaders make an incorrect decision due to lack of knowledge or poor advice.
- \* Poor organisational structure is preventing good decisions from being made

**Political factors:**

- \* Decision makers correctly represent the view of the majority in supporting projects not approved by Western methods.
- \* Political leaders make an incorrect decision because of non-altruistic motives.
- \* Projects that would normally be local issues are affected by national or even global politics because of their size.

Many of these will be interrelated, and some will have more influence than others, depending on the circumstances.

If a project benefits the World's finance houses and multinational industries, if it supports an incumbent decision-maker, and if donor country and recipient national governments have political reasons to support a project, then the technical rights or wrongs of the project itself may be of relatively little importance.

The TRL research has found little to justify the high demand for rail-based mass transit. Whilst there can be no doubts over its comfort, and the prestige that it can confer on a city, there are serious doubts over its cost and even its performance. Conversely, the busway offers unrivalled performance and value for money.

The fact that recent experience has seen a strong and growing demand for metros and LRT suggests that the influence of intangible factors is as strong, if not more so, than the technical evidence. Research at TRL is now focussing on the development of a decision support system. This should allow consideration of all of the benefits of a mass transit project, thus permitting deserving projects to receive support, while screening out projects which some would claim are justified, but which might ultimately cause severe financial hardship.

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