
World Transport Policy & Practice

Contents Volume 3, Number 1, 1997

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ISSN 1352-7614

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Publisher

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Abstracts

Livable Streets for Pedestrians in Nairobi: The Challenge of Road Traffic Accidents

Meleckidzedeck Khayesi

KEYWORDS: pedestrians, road safety, street planning

This paper examines the trend in pedestrian road traffic accident fatalities and injuries in Nairobi from 1977 to 1994. Pedestrians constituted the largest victim group of fatalities and injuries. This state of affairs is largely due to the neglect of pedestrian needs in transport planning and practice in Nairobi. The key to improving pedestrian safety in Nairobi lies in a re-orientation of transport policy from motor-vehicle fixation to pedestrian promotion. There is an urgent need for serious thought to be given to a meaningful pedestrianisation process in Nairobi.

Developing strategies to meet the transport needs of the urban poor in Ghana

E.A. Kwakye, P.R. Fouracre, D. Ofosu-Dorte

KEYWORDS: urban transport, urban poor, accessibility, quality of life

An efficient and effective urban transport sector is a means to both promoting urban development and providing adequate access and mobility to the urban dweller. In this context, in 1993, the Government of Ghana initiated its first Urban Transport Project (UTP) with the express aims of increasing and sustaining the quality and efficiency of urban transport services and making their delivery more equitable across all income categories. This improved transport, resulting in increased mobility and access to employment, markets and other centres, as well as job opportunities is of prime importance because the accessibility of the poor to these facilities is a measure of their quality of life. This paper presents the transport development strategy which has been adopted under the country's first Urban Transport Project, and assesses what the likely impacts towards poverty alleviation will be.

Appropriate Transport and Rural Development: Economic Effects of an Integrated Rural Transport Project in Tanzania

Niklas Sieber

KEYWORDS: agricultural production, non-motorised transport, infrastructure improvements

Poor transport conditions are a substantial constraint for the increase of agricultural production in Sub-Saharan Africa. Conventional rural transport projects, which focus exclusively on motorised transport can only partly remove these restrictions. Therefore, an integrated transport approach is proposed, which takes into account non-motorised transport. A field study in Tanzania

demonstrates that these interventions have at least the same magnitude of effects as rural road improvements. A system dynamics model shows that a succession of road improvements and non-motorised interventions constitutes an optimum scenario, which can be entirely financed by road pricing. This new approach towards rural transport necessitates an extension of conventional appraisal methodologies.

Solving Bangkok's Transport Woes: The Need to Ask the Right Questions

Peter du Pont and Kristina Egan

KEYWORDS: mass transit, role of government, private investment

Bangkok has a transport crisis with serious negative implications for health and welfare. Congestion is causing economic distress and technical solutions involving infrastructure development are being recommended by western consultants. The approach of government appears meddlesome due to institutional barriers, and the lack of regional land use planning and the absence of a transport strategy.

Heading for a New Transport Policy in Sweden

Hans Silborn

KEYWORDS: infrastructure investment, CO₂ targets, transport policy re-evaluation

Swedish policy makers see a need for a thorough re-evaluation of transport policy and its related governmental structures. The focus of investment will be shifted away from major infrastructure development to more modest measures such as improvements of existing routes. An important element will be improving road safety. Reduction of noxious emissions, especially greenhouse gases is seen as vitally important.

The Future of Air Travel and International Tourism

Mayer Hillman

KEYWORDS: aviation, tourism, global warming, sustainability.

Governments' attitudes towards aviation is a useful indicator of the value which they place on planetary health. With air travel increasing and a resultant growing demand for infrastructure the environment is losing out. It is important that air operators pay the full external costs of their industry and that this sector of the economy contributes to reducing its greenhouse gas emissions. This will require multilateral action to reconcile the dichotomy of promoting air travel and improving planetary health.

Editorial

THIS is the first issue of *World Transport Policy and Practice* with its new publisher, Eco-Logica Ltd. We are grateful to MCB University Press who launched the journal and saw it through its first two years of publication. Its transfer of ownership has provided an opportunity to build on the successes of the first two years and to take some new initiatives. WTPP will still provide a high quality medium for original and creative ideas in world transport. WTPP has a philosophy based on the equal importance of academic rigour and a strong commitment to ideas, policies and practical initiatives that will bring about a reduction in global dependency on the car, the lorry and the aircraft. WTPP has a commitment to sustainable transport which embraces the urgent need to cut global emissions of carbon dioxide, to reduce the amount of new infrastructure of all kinds and to highlight the importance of future generations, the poor, those who live in degraded environments and those deprived of human rights by a planning system that puts a higher importance on economic objectives than on the environment and social justice.

WTPP embraces a different approach to science and through science to publishing. This view is based on an honest evaluation of the track record of transport planning, engineering and economics. These interrelated disciplines have failed the populations of the developed world and are now failing the populations of the developing world. They have embraced a quantitative, elitist and mechanistic view of society, space and infrastructure and have eliminated people from the analysis. They have pursued narrowly defined technocratic objectives for the last 50 years and pursued many of these objectives (e.g. road building) long after the accumulation of overwhelming evidence that such an obsession was counterproductive. They are now pursuing the same narrowly based mechanistic objectives in aviation and have learned nothing from the experience of road building.

Professional transport planning in all its guises has been intellectually deficient simply because it has chosen to eliminate people from the analysis and to stifle debate. WTPP will put people at the centre and welcomes creative debate. This creative debate involves no sacrifice of rigour. Articles in WTPP will meet the highest standards of traditional academic rigour. They will be well founded on fact and experience and they will represent the widest possible consideration of the full range of issues any particular topic

raises. In this way we can work towards a more modest science and a science that is self-critical and reflective.

WTPP will encourage the flow of material from those countries under-represented in the professional world of transport publishing and from young researchers. It will work with these authors to help them to improve their material and it will identify key areas of debate for special issues. The editorial board welcomes suggestions for these key areas and offers of guest editorship.

Volume 3, No 1 carries a number of articles that begin to put these ideas into practice. Khayesi addresses the problem of pedestrian fatalities in Nairobi, Kenya and the urgent need to produce solutions to the same problem in all the rapidly developing cities of Asia and Africa. Kwakye and his colleagues ask how urban transport planning can assist the poor in Ghanaian cities, particularly Accra. Sieber assesses the importance of rural transport in Tanzania and makes connections between transport planning objectives and the impact on quality of life for rural dwellers. Peter du Pont takes us back to Bangkok and the intensity of the transport problems in this city. Bangkok has become something of a metaphor for transport failures (at great expense) in large cities and a solution to Bangkok's problems is central to the way forward in Bombay, Calcutta or Shanghai.

Two papers from Europe explore topics of global importance. Firstly, Silborn explains the Swedish response to sustainable development. Sweden has put more effort than most countries into defining and operationalising sustainable transport objectives but this is the same country that has advanced the plan for a road and rail link across Öresund to connect Malmö (Sweden) with Copenhagen in Denmark. It will be interesting to see how Sweden's sustainable development objectives make headway against the strongly entrenched economic and infrastructural plans represented by the Öresund link.

Finally Hillman takes us to the heart of what is now the most serious threat of all to global sustainable development. Aviation has taken over from the road builders as the last bastion of "predict and provide" and sees no problem whatsoever in doubling and trebling capacity every 20 years or so into the indefinite future. Our ability globally to deal with sustainable development will stand or fall on our ability to tame aviation. On current form we are not doing very well.

John Whitelegg, Editor

Livable Streets for Pedestrians in Nairobi: The Challenge of Road Traffic Accidents

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Keywords
Pedestrians, road safety, street planning

Abstract

This paper examines the trend in pedestrian road traffic accident fatalities and injuries in Nairobi from 1977 to 1994. Pedestrians constituted the largest victim group of fatalities and injuries. This state of affairs is largely due to the neglect of pedestrian needs in transport planning and practice in Nairobi. The key to improving pedestrian safety in Nairobi lies in a re-orientation of transport policy from motor-vehicle fixation to pedestrian promotion. There is an urgent need for serious thought to be given to a meaningful pedestrianisation process in Nairobi.

Introduction

Pedestrians constitute a very vulnerable group to road traffic accidents. Their vulnerability largely results from the neglect of their mobility needs in transport planning. This neglect contrasts sharply with the unrivalled and undue advantages given to the motor vehicle (Whitelegg, 1993; Conservation Law Foundation, 1995; Monheim, 1996).

In Nairobi, the capital city of Kenya, pedestrians constitute the largest single victim group of road traffic accident fatalities and injuries. The lives of pedestrians in Nairobi are therefore at great risk from road traffic accidents. In other words, the streets of Nairobi do not offer a livable environment to pedestrians. The streets of Nairobi should not just be seen as part of the urban jungle. Nor should they be viewed as satisfying mainly the needs of motorised traffic. Rather, they should be seen as livable streets. This means that they should contribute to realizing the economic and social goals of all road users, including pedestrians.

This paper examines the trend in pedestrian fatalities and injuries in road traffic accidents in Nairobi from 1977 to 1994. The paper then briefly outlines the transport policy context of pedestrian road traffic accidents. A strategy to improve the safety of pedestrians is suggested at the end of this paper.

The reality of pedestrian deaths and injuries in road traffic accidents in Nairobi

The picture that emerges from the data presented in this paper is one of increasing loss of life and injuries that accrue to pedestrians in Nairobi. Between 1977 and 1994, Nairobi experienced a rising trend in the number of road traffic accidents (Figure 1). A total of 54,350 road traffic accidents occurred in Nairobi during this period. These accidents resulted into 6005 deaths. Pedestrians constituted the largest number of road traffic fatalities (3,929 or 64.5%). The second largest victim were passengers (1,189 or 19.8%). They were followed in relative importance by drivers (615 or 10.2%), pedal cyclists (183 or 3.0%) and motor cyclists (89 or 1.5%). This aggregate pattern is more or less repeated for the individual years.

A look at the trend in serious injuries reveals that pedestrians constitute the highest single victim group also (Figure 2). Out of a total of 14,826 persons that were seriously injured, 6,465 (43.6%) were pedestrians, 4,025 (27.1%) were passengers, 2,669 (18.0%) were drivers, 913 (6.2%) were pedal cyclists and 754 (5.1%) were motor cyclists. The pedestrians are also the highest victim group with respect to slight injuries (Figure 3). There were 47,100 slight injuries, out of which 19,469 (41.3%) were pedestrians, 15,049 (32.0%) were passengers, 7,739 (16.4%) were drivers, 2,946 (6.2%) were pedal cyclists and 1,906 (4.0%) were motor cyclists.

The picture that emerges from the data in the tables and diagrams underscores the fact that pedestrians are a high road traffic accident risk group in Nairobi. The official statistics on which this paper is based reveal only a small proportion of the threat to pedestrians in Nairobi. The situation may even be worse than portrayed here if all the data on pedestrian accidents were included. There is the universal problem of under-reporting in road traffic accident statistics (Adams, 1986). The question that arises is: What is transport policy doing to improve pedestrian safety in Nairobi?

The Pedestrian in Nairobi Transport Policy and Practice

Transport policy and practice in Nairobi do not appear to reflect the reality of the trip making characteristics of the residents. Walking is a dominant mode of transport in Nairobi. A survey carried out in 1973 revealed that about 44.6% of household trips were made on foot. These trips were for essential purposes such as work, school, personal and business (Nairobi Metropolitan Growth Strategy, 1973). A 1994 survey of mode use in 302 households in a low-medium income area in Nairobi revealed that walking is the predominant mode of travel among these households. A modal split for combined first four trips in the day revealed that walking had a 47% share. It was followed by public transport (41%), private car (7%), bicycle (1%) and others (4%). The

importance of walking in these households was further emphasized by the fact that a large proportion of the first trip of the day and the most important every-day trip was made on foot. In fact, walking had over 40% share of these kinds of trips (Omwenga, Obiero and Malombe, 1994).

Pedestrian trips in Nairobi cover varying lengths, within a complex web of origins and destinations. For instance, in the survey by Omwenga *et al* (1994), the average travel length among the households was estimated at 5-8 kilometres. Residents in some new settlement areas were found to cover over 10 kilometres. Pedestrian, as well as motorised, mobility arises due to the separation of activities in time and space in Nairobi. This pattern of movement is closely related to residential patterns, location of work places, location of shopping zones and location of entertainment places. This is why there is a web of movement patterns in Nairobi in terms of origins, destinations, purpose, mode use, direction and volume. It is during these movements and interactions that pedestrians come into contact with motor vehicles.

This contact should not always lead to a pedestrian road traffic accident. However due to deficiencies in transport planning, pedestrians often become victims of road traffic accidents. Analysis of the distribution of accident spots in Nairobi reveals that the most dangerous spots are those with heavy pedestrian traffic in the CBD and along the main primary distributors leading to the CBD from low-income high density residential areas (Ogonda, 1976; Maina, 1978; Omwenga *et al*, 1993). These roads also happen to be those with heavy fast moving motor vehicle traffic e.g. Jogoo Road and 1st Avenue-Eastleigh.

Road transport planning in Nairobi is by and large motor-vehicle oriented (Omwenga *et al*, 1993). The general policy statement on urban transport in Kenya has tended to ignore non-motorized transport: walking and cycling. Priority in transport planning has been given to the development of motorized transport (Omwenga *et al*, 1993). The existing road networks in Kenyan urban areas, including Nairobi, do not meaningfully cater for non-motorised modes. The existing pedestrian infrastructure is inadequate. In brief, there is a general lack of infrastructure for pedestrians and cyclists in the urban transport system in Kenya (Omwenga *et al*, 1993).

Though pedestrian mobility needs are now

Figure 1: Nairobi: Number of road traffic accidents and persons killed, 1977-1994

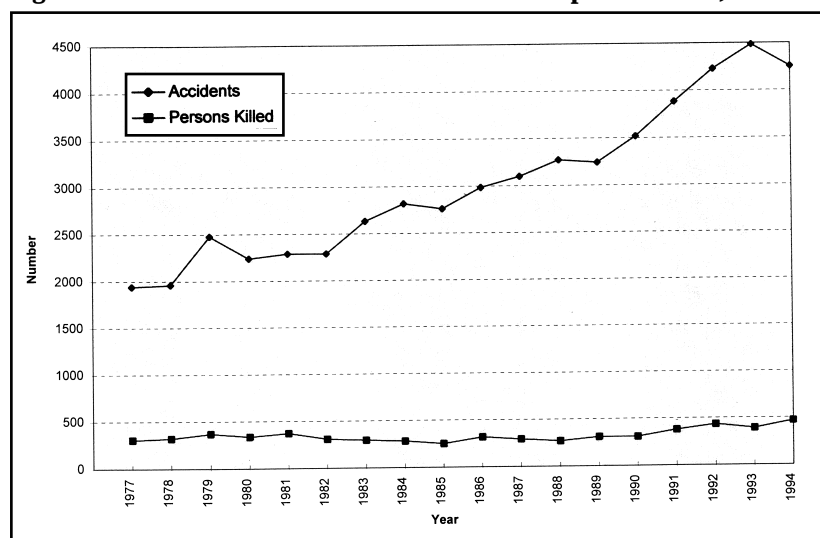
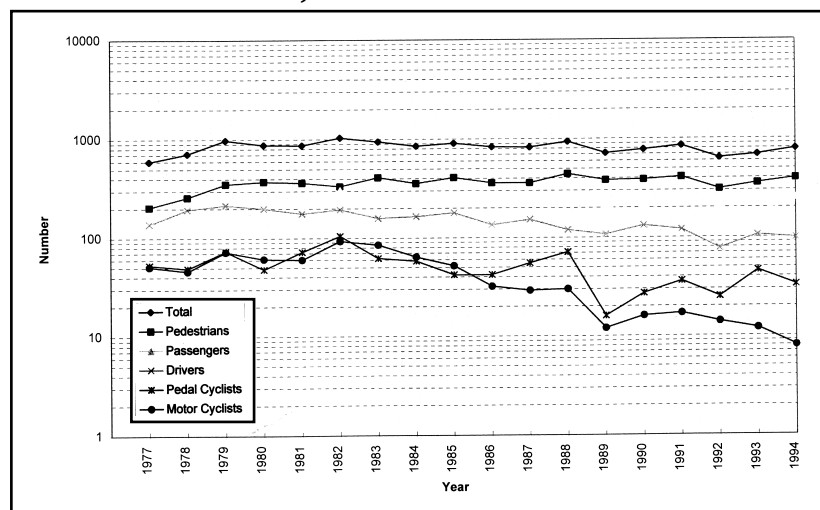


Figure 2: Nairobi: Pedestrians seriously injured in road traffic accidents in relation to other road users, 1977-1994



receiving some attention in some of the countries of Europe, the USA, Japan and Australia, no meaningful and clear policy shift are evident in Nairobi. Pedestrianisation of the transport system is yet to get the policy and action programmes it deserves in Nairobi. Nairobi has very few and inadequate (in some cases non-existing) pedestrian facilities in terms of footbridges, underground passages, exclusive walking paths, zebra crossings and pedestrian precincts. It is not unusual to find motor vehicles in narrow streets which should ideally be left for pedestrians. The situation of pedestrians is worsened by the use of limited walking space on pavements for parking and hawking. Pedestrians have therefore to use this limited space or alternatively walk on the road, thus exposing themselves more to the likelihood of being hit by motor vehicles.

The pedestrian is often blamed for carelessness as a road user. The roads in Nairobi are used by both motorised and non-motorised traffic. Such a traffic mix creates a high probability of conflict that could easily lead to a road traffic accident. This probability gets even higher in a situation where the road users do not adhere to the traffic rules, a state of affairs that is prevalent in Nairobi. The pedestrian turns out to be a weak and disadvantaged negotiator when confronted with the strong motor traffic.

Many motorists in Nairobi do not give pedestrians their right of way. Pedestrians are even in danger from motorists at zebra crossings. To facilitate pedestrian mobility at

zebra crossings, the traffic police personnel have often to stop motorists. Recently, a non-governmental organisation called Road Safety Network (RSN) was formed. This organisation deploys personnel at peak hours at critical points to control traffic. They even try to stop motorists so as to make it possible for pedestrians to cross the road. Pedestrians tend to be blamed for crossing the road when conditions are not favourable. They are accused of failure to heed the presence of vehicular traffic. Children are often blamed for playing in the road. A contextual analysis reveals that these actions cannot be wholly blamed on pedestrians. In the absence of adequate pedestrian facilities and in a situation where there is little regard for the pedestrian right of way, pedestrians are obliged to take risky actions to cross the roads. This can easily result in a road traffic accident, for instance, when an oncoming vehicle gets to the pedestrian when half-way across the road.

Reclaiming the Streets of Nairobi for Pedestrians: A Strategy

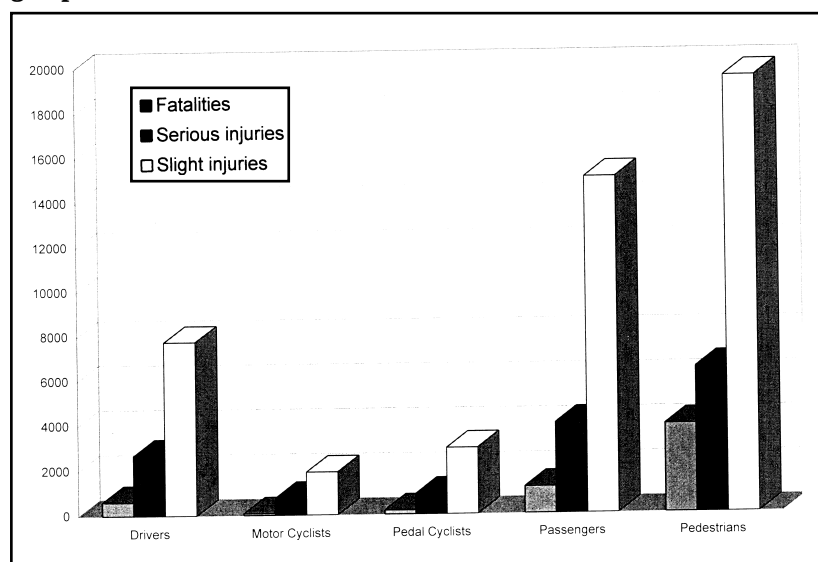
An issue that is increasingly drawing a lot of attention in transport planning is how to reclaim streets for pedestrians (Conservation Law Foundation, 1995; WALKBoston, 1996). Literature on the livability of streets indicates that streets have an important function to play in the social and economic life of the resident population (Appleyard et al., 1981; Hass-Klau et al., 1994). The livability of streets has been lost with the passing of time, largely due to increasing motorisation which led to the neglect of pedestrians in transport planning. The threat posed by road traffic accidents to pedestrians is thus a global problem.

For Nairobi, it is necessary to tackle the problem of road traffic accidents, especially with a view to making the streets livable to pedestrians. The key to tackling this problem lies in effectively and meaningfully addressing the critical issues which have been raised concerning transport planning and the road user system. The strategy to improving pedestrian safety in Nairobi requires intervention at two principal levels: policy framework and practice in transport.

Policy framework

At the policy level, there is need for a rethink. In specific terms, there is need for a comprehensive policy and institutional framework that incorporates the needs of

Figure 3: Nairobi: Road Traffic Accident fatalities and injuries by road user group, 1977-1994



pedestrians and other non-motorised traffic. The policy fixation on the needs of mainly motorised transport needs a drastic reversal. What is needed in transport policy is a re-orientation from motor vehicle fixation to inter-modal compatibility. In particular, the neglect of pedestrians has to be addressed. The present transport policy in Kenya lacks a clear statement on urban transport in general and non-motorised traffic in particular (Omwenga et al. 1993). Though it sounds altruistic, it appears that transport policy in the world generally does not fully recognise that "walking is transport" (Monheim, 1996; Nebe, 1996). At the institutional level, Omwenga et al. (1993) observe that there is no strong lead agency empowered to co-ordinate and implement comprehensive urban transport policy measures in Kenya. An effective institutional framework to consistently plan and manage the urban transport system is lacking. What exists are several agencies and institutions concerned with various transport matters at mixed levels. The need for a clear policy statement, co-ordinated institutional framework and political commitment to pedestrian needs in Nairobi will constitute the initial significant step to tackling pedestrian accidents.

Practice in transport

Beyond goal and target-setting in transport policy, there is a need to undertake specific action programmes that are aimed at improving pedestrian safety. There are a number of measures that are necessary.

Among these are: pedestrianisation of some roads in the CBD, residential traffic calming and provision of adequate pedestrian facilities (walking lanes, zebra-crossings, footbridges, underground passages, enough time for pedestrians at traffic lights). Along with these action programmes is the need for effective legal enforcement which incorporates a strong element of road safety education. A city-wide programme of road safety education is needed in Nairobi. This will conscientize Nairobi residents to the dangers of road traffic accidents, more so to the need to improve personal behaviour on the road. In other words, road safety in Nairobi needs to be community-oriented, whereby the residents and road users see themselves as part of the problem and solution to road safety.

Conclusion

An analysis of road traffic accident statistics for Nairobi for the period 1977-1994 reveals that pedestrians are the largest single victim group of fatalities and injuries. The increasing vulnerability of pedestrians to road traffic accidents is largely due to the neglect of their needs in transport planning in Nairobi. There is a strong orientation towards the needs of the motorised traffic at the expense of non-motorised traffic in Nairobi. The key to solving pedestrian safety in Nairobi lies in policy re-orientation which should address the neglect of pedestrians. There is an urgent need for meaningful traffic calming measures to be undertaken in Nairobi.

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Developing strategies to meet the transport needs of the urban poor in Ghana

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Keywords

Urban transport, urban poor, accessibility, quality of life.

Abstract

An efficient and effective urban transport sector is a means to both promoting urban development and providing adequate access and mobility to the urban dweller. In this context, in 1993, the Government of Ghana initiated its first Urban Transport Project (UTP) with the express aims of increasing and sustaining the quality and efficiency of urban transport services and making their delivery more equitable across all income categories. This improved transport, resulting in increased mobility and access to employment, markets and other centres, as well as job opportunities is of prime importance because the accessibility of the poor to these facilities is a measure of their quality of life. This paper presents the transport development strategy which has been adopted under the country's first Urban Transport Project, and assesses what the likely impacts towards poverty alleviation will be.

Ghana would not cross the poverty line for another half century.

In 1993, as a logical sequence to the ERP, Ghana in association with the World Bank, launched its Accelerated Growth Rate and Poverty Reduction Programme. This aims to consolidate and build on the earlier economic achievements in order to further advance the goal of poverty reduction in the country. Ghana needs to strike for faster growth through policies that will create opportunities and tangible change for the poor. The anticipated accelerated growth is expected to go hand-in-hand with poverty eradication (World Bank, 1993). Ghana's national planning document, Ghana-Vision 2020 (Government of Ghana, 1995), foresees Ghana attaining the status of a middle income country over the next 25 years. Initiatives like the Gateway Programme, creation of Free Enterprise Zones and the encouragement of private sector capital investment are being promoted in support of this objective.

As the World Bank has noted, cities of the developing world are major engines for economic growth (World Bank, 1996), and as a result, more attention is being focused on urban development as an important part of the national growth process. Furthermore, the alleviation of urban poverty has been identified by the World Bank as one of the three priorities for urban development in the 1990's (World Bank, 1991).

An efficient and effective urban transport sector is a means to both promoting urban development and providing adequate access and mobility to the urban dweller. In this context, in 1993, the Government of Ghana initiated its first Urban Transport Project (UTP) with the express aims of increasing and sustaining the quality and efficiency of urban transport services and making their delivery more equitable across all income categories. It is expected that as a result of

1 Introduction

By the end of the 1980s, Ghana's per capita income placed it among the world's poorest countries. Ghana continues to have high dependence on a small range of exportables (principally cocoa, gold and other minerals), low domestic savings, low aggregate investment and a low level of private investment. It is generally estimated that even with the improved economic performance since the launching of its Economic Recovery Programme (ERP) in 1983, real growth has only been about 5% per annum, with per capita income rising at about 2% per annum. At this rate, it was estimated that the average poor person in

the UTP many of the urban poor will benefit from improved transport, resulting in their increased mobility and access to employment, markets and other centres, as well as job opportunities. This is of prime importance because the accessibility of the poor to these facilities is a measure of their quality of life. Improvements will also enhance their productivity and contribution to the national economy.

This paper presents the transport development strategy which has been adopted under the country's first Urban Transport Project, and assesses what the likely impacts towards poverty alleviation will be. Reference is made mostly to Accra, the main city of Ghana, but the conditions described apply equally in the other large cities, Kumasi, Takoradi, Tema and Tamale.

2 The Urban Poor

In Ghanaian cities the existing urban poor communities are not confined to inner or outer areas of the city. For example, in the Accra Metropolitan Area some of the communities, particularly those of the original or indigenous Ga settlers, are very centrally located within the city while others are some 20 km from the Central Business District (CBD). However, it is evident that new urban poor settlements are springing up on the periphery of the city, and that these are likely to accommodate an increasing proportion of the city's poor over time. This will have a longer term impact on travel patterns, thereby placing an increasing burden on the existing inadequate public transport services.

Most of the poorer communities have developed as squatter settlements on less favourable residential land with poor drainage which is often subjected to flooding after heavy rains. Almost all are built-up areas with little room for expansion. Conditions are generally deplorable with inadequate supporting social and engineering infrastructure. Buildings are of poor material and structural quality with low maintenance

levels. Most houses cannot be accessed by motorised transport. However, there are some lanes between buildings which are used for pedestrian access, but also serve as drainage channels.

Overcrowding in the houses is common with the indigenous areas of Accra having an average of 3.6 persons per room and 29.5 persons per house whilst the non-indigenous areas have 3.1 persons per room and 30.4 persons per house (APDP, 1990). In some poor communities household occupancy rates have been recorded as high as 8 persons per room. Fluctuations in household size, which result from more open boundaries of family membership, are also apparent (Grieco *et al.*, 1996).

In the very poorest communities of Accra, almost 70% of personal incomes were below the 1992 Accra average monthly earnings of ₵24,691 (about US\$40 in 1992 prices). There is evidence, however, that some middle and higher income families continue to live in these depressed areas. This may be partly out of choice to remain within ones traditionally or indigenous 'accepted community' and partly because of the high rents charged in other areas within the city.

3 Transport availability

3.1 Vehicle ownership

Motor vehicle ownership for the whole of Accra was 35.7 per 1000 population in 1993, with an average annual growth rate of 4.1% between 1987 - 1993. The distribution of vehicle ownership by income category is not known, but it can be expected to be highly skewed towards the high income households.

Statistical data on bicycle ownership are not known with any certainty. However, from a survey of travel in the poorer communities of Accra, it has been estimated that per capita ownership levels of bicycle range between 30 and 120 bicycles per 1000 persons (TDP, 1992b). Even if these figures are realistic, it is clear from traffic counts and general observation that cycles are not widely used in daily travel. The higher bicycle ownership levels recorded in some areas reflect the fact that these communities have a marked 'cycling culture' which is associated with their ethnic origins such as those from the Northern half of the country (Grieco *et al.*, 1995). The survey also indicated that for every bicycle owner there were another 1.5 persons who had access to the use of the same bicycle.

Table 1 ESTIMATED TAXI AND TROTRO OPERATIONAL FLEET IN ACCRA

	Shared Taxi	Trotro	Total
Vehicle fleet in use	6,500	3,200	9,700
Seat capacity	26,000	48,000	74,000
Vehicle per 100,000 pop	42	21	63
Seats per 100,000 pop	169	312	481

3.2 Public Transport

In the main, public transport services are provided by shared taxis and 'trotros' or minibuses (Fouracre *et al.*, 1994). Taxis have a legal seating capacity of four passengers, while the trotros range in size from 12 to 30 seats. There are limited numbers of bigger buses; those in use are mainly operated by industrial companies for use by employees. A range of services are offered by these vehicles, including chartering, point-to-point ('dropping') and fixed route sharing or 'joining' (Grieco *et al.*, 1996). The estimated operational fleet strengths of shared taxis and trotros are shown in **Table 1**.

Access to public transport from the depressed areas seems reasonable though the terminal facilities are poor. Fare levels on taxis tend to be about twice those on trotros for any given trip length. There is no obvious differentiation in fares between services to higher and lower income communities. However, there are differences in service quality between richer and poorer communities. For example, trotros serving the squatter settlement of Tsui-Bleoo in the Teshie area of Accra are very old and in poor state of repair. Their drivers avoid using the main roads of Accra for fear of police arrest.

Fares also vary with the type of service provided (Grieco *et al.*, 1996).

Average waiting times at terminals are very variable with some high recorded maximum values; passengers often have to struggle for the few available seats. Taxi waiting times between terminals are one third to half of those of trotros. This should be expected because taxis are far more numerous and are thus likely to be operated at higher frequency with resulting lower waiting times. Taxis are also more highly utilised than other public transport vehicles. They cover 240 km per day as against 160 km for trotros and 90 km for big buses (Ofosu-Dorte, 1994).

3.3 Roads

The road conditions within the depressed areas are for the most part poor. Almost half of the road lengths have no engineered surface. Even then some of these poor roads are being used by vehicles since there are no alternative roads leading into these poor areas. Although, over a quarter of the roads have surface dressing, these have an extensive degree of deterioration with only one third being in good condition. There is lack of pedestrian walkways, coupled with the hazards of open drains. Where walkways do exist they are often used for street trading.

By contrast, the road network in the high income areas of the city are generally of a higher standard. They are more likely to have a properly engineered surface, and are maintained to the highest level possible.

4. Travel characteristics

The distribution of trip lengths from the depressed areas has been established by sample survey. Figure 1 shows the cumulative distribution of trips for each mode by trip length. Forty per cent of trips by all modes are less than 5 km, while 75 per cent are less than 10 km.

Modal choice is strongly associated with trip distance, as is shown in Figure 2. There is a marked increase in the proportion of trips undertaken by the trotros with increasing trip distance. For non private-car trips in excess of 25 km, which constitute about 5% of all trips, over 90% are undertaken by trotros. The majority of short distance trips which are less than 5 km are undertaken by walking. The proportion of trips undertaken by taxis are relatively independent of trip distance. Taxis carry about 20 - 25% of all trips on distances up to 25 km. Beyond this distance the taxi share drops to below 10%.

Figure 1: Trip length distribution for each mode

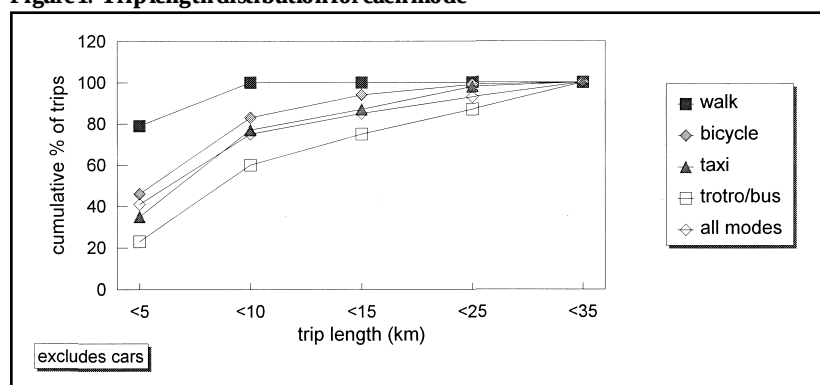
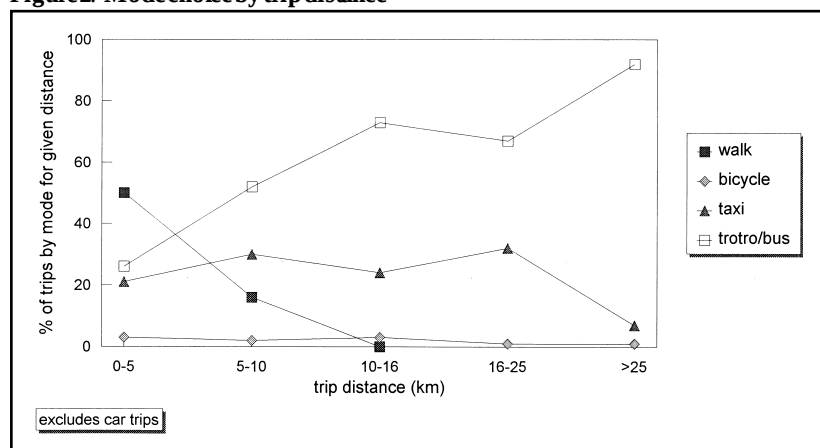


Figure 2: Mode choice by trip distance



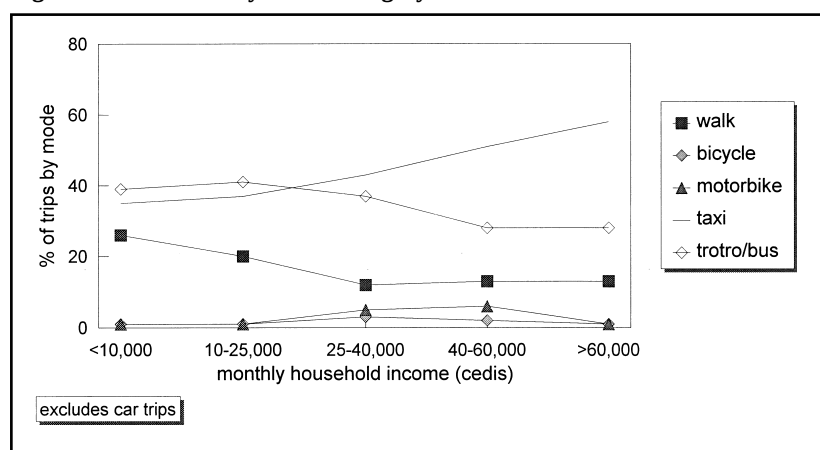
Use of shared taxis and trotros is strongly associated with income, status and gender. The higher a travellers' income and, in all likelihood, status the more likely the use of taxi, and the less likely the use of trotro. This is shown in Figure 3. Taxis are not only convenient to use but also more comfortable to ride in because of the fewer number of passengers they carry and the low floor clearance compared to the size of the trotros. Comparatively, the trotros are big, uncomfortable, and in some cases difficult to access by women when they are carrying loads or babies. Women, especially those in the middle and higher income groups, are probably more likely to use taxis in preference to trotros, though there is no substantive data in this report to support this. This is due not only to the convenience of the taxis, but also to the nature of the

choice of modes. They 'both adapt their transport behaviour to the poor quality and low reliability of existing informal transport systems and creatively adapt the local informal public transport system to their business needs' (Grieco *et al.*, 1996).

Expenditure on transport as a proportion of total daily expenditure is broadly correlated with income levels. In general, higher income earners spend less on transport as a proportion of total daily expenditure. Table 2 shows the transport expenditure patterns for a sample of workers in different earning categories. The very low income earners spend less, as a proportion of income, than the next category. This probably reflects the fact that wage earners with very low incomes cannot afford to use even the cheapest public transport on a regular basis. Transport for this poorest category is largely by walking.

Travel speeds in Accra are poor and are constantly, over the years, getting worse. In the central areas, average peak hour speeds declined by about 12.5% in the three year period between 1987 and 1990. Since then there has been continued decline and current evidence suggests that speeds in the CBD are below 10 kmph.

Figure 3: Mode choice by income category



Ghanaian society, whereby women are more conscious of their dress when they are travelling than their men counterparts and also due to their status in the society.

Mode choice is also a particular consideration for female traders, as has been powerfully demonstrated in the work of Grieco *et al.*, (1996). This group, which plays an important role in the Ghanaian economy through ensuring local availability of goods, has the need for diversity and flexibility in

5. Improving the mobility and accessibility of the urban poor: design of the urban transport project.

In order to improve upon the mobility and accessibility needs of the urban poor in the country, the Government of Ghana approached the World Bank for assistance. This culminated in the negotiation of a World Bank sponsored Urban Transport Project (UTP) in 1993 for the five major cities of the country namely, Accra, Tema, Sekondi/Takoradi, Kumasi and Tamale at a total cost of US\$87.6 million. While the World Bank is providing US\$76.2 million, the Government of Ghana is financing the remainder from its own resource as counterpart funds.

5.1 Outline of the Urban Transport Project (UTP)

There are five main components in the UTP. These are:

1. Road rehabilitation in Accra and Sekondi/Takoradi;
2. Traffic management improvement and accident reduction measures;
3. Lorry parks and bus terminal rehabilitation;

Table 2 EXPENDITURE ON TRANSPORT BY WAGE EARNERS

Earnings C per month	Transport cost as a proportion of total daily expenditure
0-10,000	13.7
11,000-25,000	24.2
26,000-40,000	12.0
41,000-60,000	11.6
>-60,000	4.3

4. Construction of non-motorised transport facilities and access roads to low-income areas;
5. Technical assistance to central and local government agencies for policy development; project preparation and implementation, and institutional development.

While it is expected that all the components of the project should have a positive impact on the accessibility and mobility of the urban poor in the country, some of these measures are particularly targeted at the urban poor areas, especially in Accra as their specific circumstances dictate.

5.2 Bus terminal rehabilitation

The UTP includes improvements to the surfacing, drainage, access control, lighting, and the provision of shelter, sanitary and refreshment facilities to selected terminals in all the five main cities of Ghana. Bicycle storage facilities are also to be provided to complement the non-motorised transport components and to encourage people to cycle to and from terminals in the manner of a '*park and ride system*'.

5.3 Non-motorised transport facilities

In support of the Government's policy to provide balanced development of transport modes in the urban areas, the project makes provision for the construction of around 50km of dedicated cycle paths connecting low and middle income residential areas to commercial and business districts in Accra. Cycle lanes and tracks have also been incorporated as part of the road rehabilitation designs for Accra. In the proximity of markets, these tracks and lanes will be wide enough to accommodate the manually pushed trolleys which are widely used to transport goods between the markets and the terminals/ lorry parks for the traders.

These 'pilot' paths will form the initial phase of an integrated bike path network for Accra and eventually for other cities and metropolitan areas of Ghana. A study will be undertaken to produce a master plan for the development of a comprehensive bike path network for the whole of Accra.

Seven low-income areas in Accra, identified as having the worst access problems, namely, Teshie old Town, Chorkor, Russia, Sukura, Sabon Zongo, old Nungua and Abeka will be connected to the main arterial routes with basic surfaced roads, thereby reducing the

operating costs of public transport which in turn will help reduce the transport burden of the urban poor living in these areas. Access to selected markets is also to be improved through the construction, or designation, of dedicated tracks or lanes between lorry parks and markets for non-motorised transport, such as hand-carts.

5.4 Policy support

Specific Urban Transport Policies are to be developed which will focus on the following issues:

1. Regulatory options for improving the quality and quantity of public transport;
2. Management of bus terminals;
3. Management of parking in the main cities;
4. Options for private sector participation in the Government owned bus companies,
5. Restructuring of the Vehicle Examination and Licensing Division and the National Road Safety Committee in order to minimise road accidents and their effects on the society especially in the poor communities.

The general aim of this set of policy-related studies is to develop an operating environment in which an effective and efficient public transport service will flourish. This should be for the benefit of the urban poor who depend so heavily on public transport for accessibility and mobility. Policy development will be within a general framework of trying to achieve a self sufficient sector in which the '*user pays principle*' is followed.

5.5 The expected benefits and impact of the Urban Transport Project

The project is designed to improve the efficiency and increase the capacity and safety of urban public transport and road network operations in Ghana. It is expected to reduce traffic delays and congestion in the five urban areas by better organising and controlling the flow of buses, other motor vehicles and non-motorised transport. It will improve access and circulation, reducing passenger and freight transport costs, and hence improve the performance of the urban economy.

While a broad cross-section of Ghana's population will benefit from improvements in the urban transport system, many of the urban poor will particularly benefit from improved transport from their homes to

markets and the main roads. This is expected to result in increased mobility and accessibility to job opportunities brought about by improved taxi, trotro and bus services, safer pedestrian pathways and increased bicycle usage.

6 Status of implementation of the UTP

The UTP has been in progress for almost three years. The access roads to the depressed areas of Accra have been designed, and work has started on implementation. The Department of Urban Roads (DUR), the executing agency for this work, has laid great stress on the public presentation and discussion of the designs with the local communities involved. Apart from generating local goodwill, this participation is to ensure that designs meet community needs.

The DUR is also using public participation exercises, or so-called 'user platforms' to help in the development of the designs for the non-motorised paths, which are currently being formulated. The originally conceived pathways have been modified as a result of these consultations, and the result is that the paths which will be constructed are more closely aligned to the existing main areas of cycle use. An innovation in the design work has been the use of a sociologist and an experienced non-motorised transport expert, to help identify how best the communities can be served by the paths, what design features will improve their acceptance, and how best to promote the use of the paths, given the existing behavioural patterns of cyclists, and the attitudes towards cyclists by other road users and the community at large (Turner *et al.*, 1996).

The designs for the public transport terminal improvements have also been completed, and will similarly be presented by DUR for public acceptance. An important aspect of the rehabilitation work is the need to put in place an efficient and sustainable management system which can maintain continuing high standards of operation at the terminals. The Ministry of Transport and Communications (MOTC) is putting in place the institutional arrangements for supporting the Metropolitan and Municipal Assemblies (MMAs) who have the responsibility for running the terminals. Management of the terminals will be contracted out to the private sector on the basis of an open tender competition.

The MOTC and DUR are also collaborating in

giving more general support to the MMAs to develop their technical capacities to plan for traffic and transport. The MMAs have a weak technical capacity in this field, which is now receiving attention as part of a wider policy of decentralising the powers of central government. The DUR, which is a central government agency, has already developed Roads Units within the five main MMAs. These Units initially have the role of road maintenance within the MMAs, but their responsibilities will gradually be developed to include more major road works, traffic management and public transport monitoring and control. This process of expanding the role of the Roads Units has started under the UTP, through the creation of *Traffic and Transport Units* (TTUs). The TTUs are being formed to oversee the management of the public transport terminals, and to implement the policy initiatives towards urban parking, which have been developed by MOTC.

MOTC is centrally involved in the institutional and policy development aspect of UTP, and has set up an Urban Transport Unit (UTU) as a dedicated cell to handle its programmes (Kwakye and Fouracre, 1996). The UTU has been developing the institutional framework through the creation of an Inter-Ministerial Committee, which functions at various levels by bringing together all interested parties on a regular basis. It is through the UTU that MOTC has been working directly with the MMAs to create the necessary organisational and management structures required to manage effectively traffic and transport in the cities. The UTU is also trying to promote, through training programmes, the development of an urban transport planning expertise in the Agencies concerned.

7 Conclusion

Transport plays an important role in city life, not least for the urban poor who largely rely on the provision of public transport services on which they spend a large proportion of their income. The importance of transport issues in the life of the urban poor can be seen in the findings from a survey of community improvement projects. The up-grading of roads and drainage ranked second in depressed community priorities, ahead of such other worthwhile schemes such as the provision of health centres, schools and markets.

While transport improvements cannot by

themselves solve the problem of poverty, they can contribute to a more efficient urban organisation, and a higher quality of life. A key feature of Ghana's Urban Transport Project is therefore to promote projects which will have a specific and positive impact on the lives of the urban poor. Furthermore, in order that these projects can be sustained, the UTP has stressed the need for public participation and consultation, as well as the development of institutional structures

which can carry the process of development forward at the end of the current project.

Ghana's UTP is still in progress and some of the important components have still to be realised. However, it is clear that the original project conception was well founded, and that a significant and positive impact is being made on transport development in the main cities. Urban transport is at last being given the support it deserves, and the urban poor will be major beneficiaries.

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Appropriate Transport and Rural Development:

Economic Effects of an Integrated Rural Transport Project in Tanzania¹

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Abstract

Poor Transport Conditions are a substantial constraint for the increase of agricultural production in Sub-Saharan Africa. Conventional rural transport projects, which focus exclusively on motorised transport can only partly remove these restrictions. Therefore an Integrated Transport Approach is proposed, which takes into account as well the non-motorised transport. A field study in Tanzania demonstrates that these interventions have at least the same magnitude of effects as rural road improvements. A system dynamics model shows that a succession of road improvements and non-motorised interventions constitutes an optimum scenario, which can be entirely financed by road pricing. This new approach towards rural transport necessitates an extension of the conventional appraisal methodologies.

Introduction

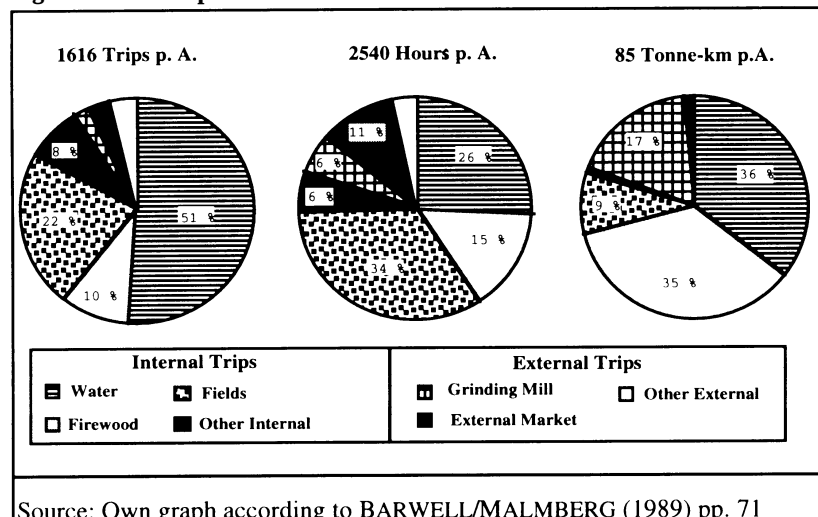
Poor transport conditions are regarded as one of the main constraints for rural development in Sub-Saharan Africa. As a result, since 1946 the World Bank spent more than US\$ 62 billion world-wide in over 1,000 transport projects. Transport investments, comprising 13-16% of the Bank's total expenditure, were exclusively used for the improvement of motorised transportation.

The focus of donors on 'roads and cars' has been criticised since the 1980s, because the transport needs of rural households, com-

prising two thirds of the population were neglected. In his famous World Bank Paper "Rural Poverty Unperceived" Robert CHAMBERS (1980) linked rural indigence firmly to lack of mobility. Four years later another World Bank Paper by EDMONDS and RELF conclude that 'plans, projects and existing policies in the transport sector do nothing or little for the rural poor'. This group of 'transport disenfranchised' can be conservatively estimated at world-wide to be in the order of 700 million people. One of the main reasons is the low rate of motorisation, which is 8 vehicles per 1,000 inhabitants in Sub-Saharan Africa². A number of recent studies³ show that the rural population of many Developing Countries moves mainly by walking on paths and trails away from the rural road network and undertakes very few motorised trips. The majority of time and effort is spent for transport purposes which secure the household's subsistence needs. Here the Makete District in Tanzania may serve as an example⁴. A household with five persons undertakes more than 1,600 trips annually, which require more than 2,500 hours (Fig 1). The procurement of energy and water, which is available in industrialised countries instantly requires annually more than one thousand hours. During one year an average household transports 85 tkm. Two thirds of transport time is spent in and around the village. The biggest share of the transport burden is carried by women.

The effort, drudgery and the high time requirements for transport purposes significantly hamper the growth of per annum agricultural production: In labour intensive economies this allocation of time is a drain on a households labour resources. Time constraints may have severe negative impacts on the productivity, especially during peak working periods, e.g. in the harvesting season. In Makete more time is spent on transport activities than on labour in the fields. JENNINGS (1992, p. 29) reports that many women in the Makete District "indicated that they had additional shambas (fields) which they could cultivate if they had additional time". According to the International Food Policy Research Institute (MELLOR, 1985) the lack of labour is the main

Figure 1 Transport activities in Makete District 1986/87



Source: Own graph according to BARWELL/MALMBERG (1989) pp. 71

reason for the low agricultural production: "Africa's poor record on food production is largely due to labour constraints ... These serve to reduce labour input into agriculture, slowing the expansion of area cultivated as well as the yields per acre."

Therefore, one of the main goals of rural transport projects should be to reduce the household's time requirements for transport purposes. The question arises whether the time savings will be used for production increasing activities. The farm households can use 16 hours of their daily time budget⁵ for labour on the fields, for leisure and for domestic tasks like water and firewood collection. The amount of time used for household tasks determines how much time is left for leisure and labour. In the initial situation household tasks **restrict** the maximum available for leisure and labour to time L_{maxR} . The production frontier P_R indicates how much output can be produced with different inputs of labour time within the given time restriction L_{maxR} . The decision how much time is used for crop production and how much leisure time remains can be visualised by a set of indifference curves $I_1, I_2 \dots I_n$, each of them symbolising a different level of utility of a given utility function. The farmers will choose the indifference curve I_R in order to find the optimal production O_R , which necessitates a labour input of $L_{maxR} - L_R$ and leaves leisure of L_R .

A different situation occurs after transport interventions have reduced the time requirements for household tasks: the maximum labour time moves from L_{maxR} to L_{maxA} , the production frontier shifts from P_R to P_T , a

new indifference curve I_T is chosen resulting in an output of O_T . The graph shows that the saved time will be partly used for leisure, but the remaining time is used to increase agricultural output. Thus a reduction of the household's transport time will entail a production increase.

Therefore the transport planning must be adapted to

the needs and economic means of the rural population:

- Promotion of affordable Intermediate Means of Transport (IMT).
- Implementation of a network of paths, trails and tracks, which can be used by the IMT and complement the existing road network.
- Labour based and low cost construction and maintenance of the infrastructure.
- Transport avoiding measures to reduce trip length to public services and to sources of energy and water.

Economic Effects of the Makete Integrated Rural Transport Project

The understanding that "Roads Are Not Enough"⁶ was the reason why the International Labour Office conducted an Integrated Rural Transport Project in Makete District, Tanzania. The district is located in the south west of Tanzania and stretches over a mountainous plateau containing mountains, hills, ridges, valleys and steep escarpments. The population lives mainly in scattered settlements and the average density amounts to 18 persons/km². The economy basically relies on subsistence agriculture. The agroecological conditions are favourable for the rainfed cultivation of crops from tropical and moderate climates. The latter are traded with the hot lowlands. The salient feature of the regional development in the Makete District is the shift from subsistence economy towards market orientation. In 1994 still less than half of the products harvested are marketed which generated annual revenues of US\$80 per household.

Figure 2: Effects of reduced time requirements for transport

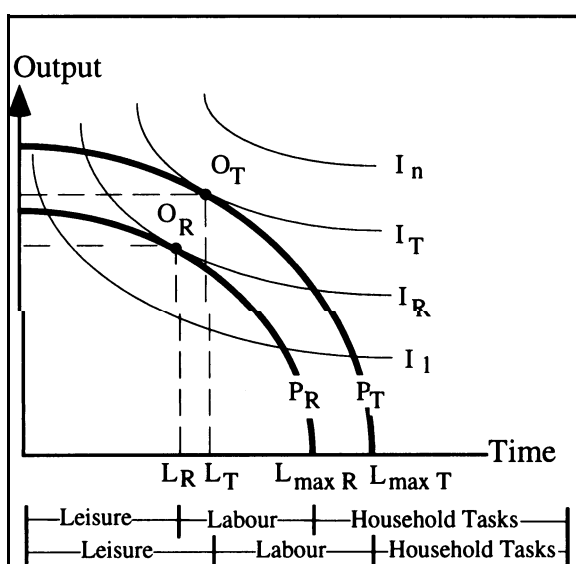
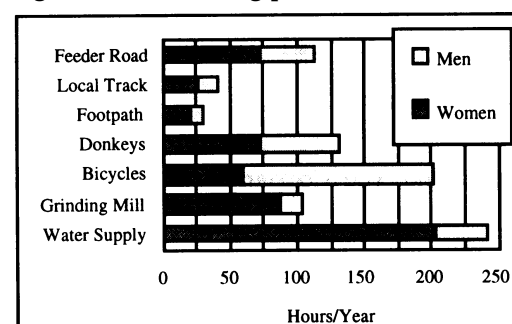


Figure 3 Time savings per household



The project had the aim to reduce the transport burden of rural households. Low-cost roads and tracks were constructed and improved with unpaid Self-Help-Labour, Intermediate Means of Transport (IMT) were developed and promoted and a number of

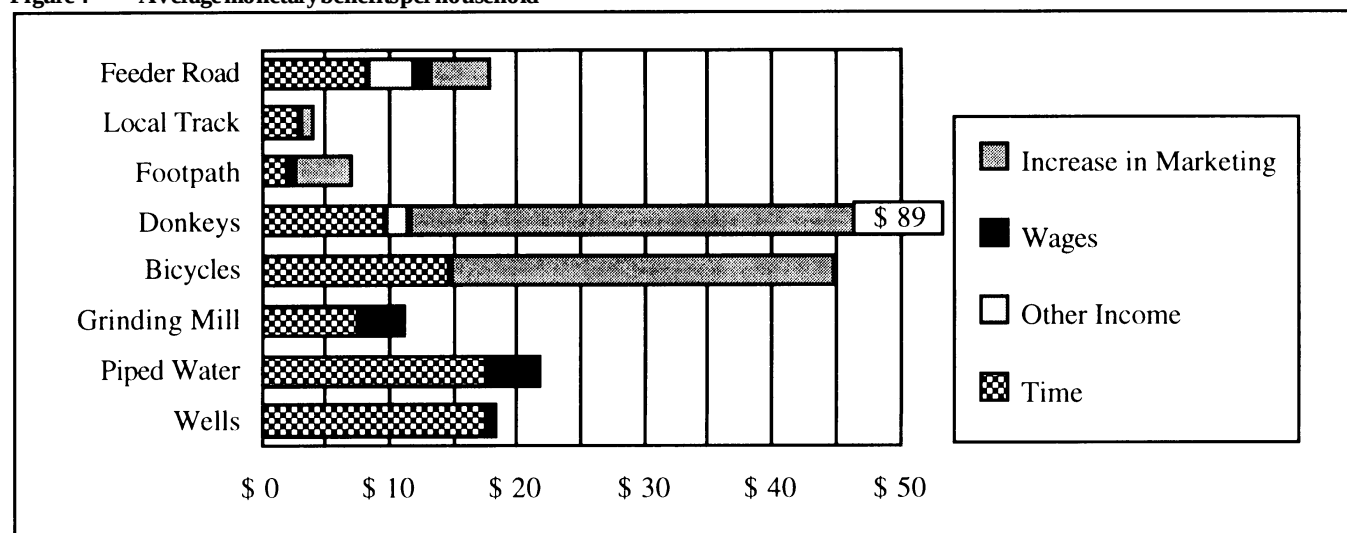
transport avoiding measures introduced. Before the project started and at its termination a survey of the transport and production activities of rural households was conducted. The data base allows a detailed analysis of the impacts of the various transport interventions on the household level.

One of the salient effects are time savings, which are an indicator for the reduction of the transport burden. Figure 3 shows the changes of the time budget of an average household benefiting from the transport improvement. The biggest effects can be achieved by the installation of water supply

decreasing to increasing returns of scale. Donkeys are mainly used for the transport of products from the field, while bicycles transport fertiliser and grain to the grinding mills and generate more trips outside the village than in non-bicycle-households. The latter reduces the isolation of the household. The main restriction for the purchase of IMT are the relatively high procurement costs. 80-90% of the households desiring an IMT stated that they could not afford the price, which amounts to the annual marketing revenues.

Traffic avoiding measures like the installa-

Figure 4 Average monetary benefits per household



systems followed by the promotion of bicycles and donkeys. While mainly women benefit from the first intervention, the bicycle reduces the time consumption predominantly for men. Women profit more from grinding mills and donkeys. But also the feeder road causes a significant reduction of the female time used for crop marketing.

Figure 4 lists the total monetary benefits⁷, which are made up of the monetarised time values, the increase in marketing, the salaries earned by the project implementation and other sources of income like hiring of vehicles, lending of donkeys etc. The biggest monetary benefits are caused by **DONKEYS** which are followed by **BICYCLES**. The survey found that both have very strong impacts on market production: They enable farmers to cultivate bigger fields and use more fertiliser. Donkey-households market twice as much, and bicycle-households two fifths more than comparable non-IMT-households. The purchase of IMT changes the productivity of the household from

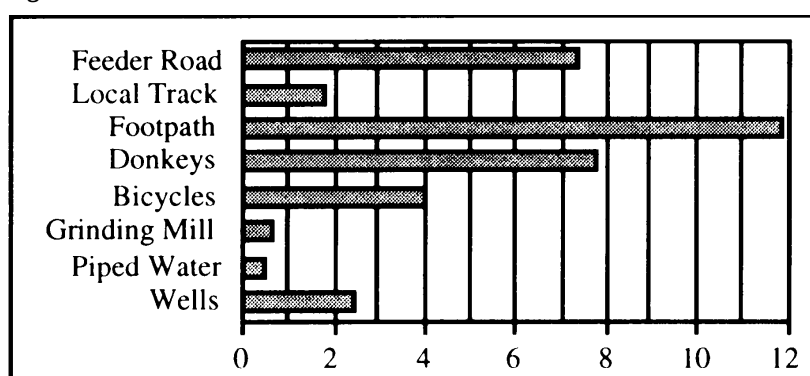
tion of **WATER SUPPLY** systems have a significant impact on the time budget of rural households. The relatively high costs for piped water entails a benefit/cost ratio lower than one (Figure 5). If low cost wells instead of expensive pipes are chosen the ratio increases up to 3. The non-monetary benefits from the improved water supply due to enhanced health cannot be assessed.

The benefits of the **FEEDER ROAD** consist of time savings (46%), marketing increases (27%), income by hired vehicles (21%) and income by project employment (6%)⁸. The benefits from road improvements are distributed unequally among the survey villages. Two survey villages with the best road access could not take advantage of the improved marketing possibilities: In the first village which was a traditional source for migrant labour, the rural exodus increased and the agricultural production stagnated. The second village could not compensate for the breakdown of the regional pyrethrum market, while a neighbouring village performed

surprisingly well, even though its road access strongly deteriorated. The latter village profited from its traditional trading links and transported the whole market production by headload down a steep escarpment. The strongest impacts of the road investment were registered in a village, which is too far away from the market to undertake daily return trips and where heavy, low value products are cultivated. Here transport by headload would be too time consuming and tiring.

Agroecological frame conditions, traditional trading links and walking access to the markets seem to be as important for market integration as road access. Many inhabitants of villages within walking distance to the market prefer to carry a big portion of their goods by headload to the market in order to profit from price arbitrage. This is even the case when good road access exists. The feeder road shows the second best benefit/cost ratio (Figure 5). The main reasons are the low costs of the road rehabilitation with high labour, and low machinery input. If the costs of commercial capital based road construction projects in Tanzania would be applied the benefit/cost ratio of the feeder road would decrease to two!

Figure 5 Benefit/cost ratio



The feeder road performs better than the **GRINDING MILLS**, which benefit mostly from time savings. The high costs entail a benefit/cost ratio below one. The fact that households use their scarce monetary resources to pay the fees for grinding shows that benefits other than transport time savings must be taken into account. The alternative of grinding by hand seems to be so arduous, that the service is valued more highly than the benefits from the saved transport time.

The cheapest transport intervention was the improvement of a **FOOTPATH** with regional

importance leading down a steep escarpment to a regional market. Especially during the rainy season when paths become slippery like soft soap, travelling is a dangerous undertaking and more often than not these paths are avoided. Obstacles like rivers, marshes and invading vegetation force the travellers to walk big detours. The project trained gang leaders and foremen to conduct simple improvements on the path such as building wooden bridges and staircases, digging small ditches for drainage, constructing timber guard barriers and winding the path on steep slopes. The local population gave very positive feedback regarding the impacts of the improvements: Travel is much faster and safer, bigger loads can be carried and one third of the households is able to reach new places. The latter statement must not be underestimated because path improvement is an appropriate measure to reduce rural isolation. Agricultural production in the catchment area increased more strongly than in comparable villages. The number of pedestrians using the path to reach a regional market is higher than that of passengers using the feeder road mentioned above. A considerable amount of traffic was generated by footpath improvement. The absolute benefits from the improvement are nevertheless quite small, because the catchment area has a "traditional" low market orientation. But the low construction costs attribute the high benefit-cost-ratio to footpath improvement.

A local trail connecting a village with the ward centre was widened to a **MOTORABLE TRACK**. While the village representatives emphasised the large benefits due to increased health care and the appearance of traders in the village, the monetary benefits and the benefit/cost ratio are relatively low. The construction of tracks could possibly be economically warranted if they would be used by bicycle-trailers or animal drawn-carts.

Conclusions

The improvement of footpaths can be a very efficient and cheap measure to stimulate the marketing of primarily subsistence oriented villages within walking distance to regional markets. If the distance to the market is longer than a half day walk then motorised access is a necessary precondition for regional market integration, but it does not automatically stimulate the development

process. The increasing marketing entails the growth of production and market related transport tasks: in this phase the purchase of Intermediate Means of Transport can induce another sharp increase of agricultural production. The strong effects and the high benefit/cost ratio warrant the promotion of IMT. Traffic avoiding measures can only be economically justified if they are low cost interventions. Other non-transport effects, like health improvements, are probably bigger than transport related benefits. **Comparing the absolute effects and the cost efficiency it can be safely stated that non-motorised transport interventions have the same magnitude of impacts as interventions in the motorised sector.**

Transport Interventions and the Dynamics of Rural Development

A rural development process entails increasing time requirements for production and marketing related transport activities. The limited time budget sets restrictions for the further increase of productive activities. On the other hand rising cash incomes give an opportunity to use more non-labour inputs like seeds and fertiliser, which entail a further growth in production. It is difficult to judge the effects of the various interrelations, feedbacks and restrictions. Therefore an econometric model was designed in order to analyse these interrelations by using a system dynamics approach. The software used was developed by the Michigan Institute of Technology and its most popular applications were the world development scenarios published by the Club of Rome.

The model describes the nexus of production and transport as it was observed in Makete.

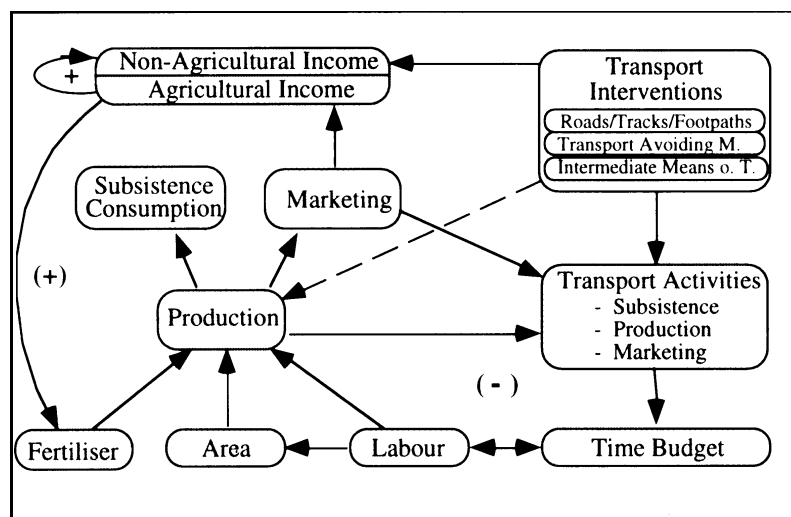
The main system features are given in Figure 6. Agricultural production, which is the salient variable of the system, is determined by the following inputs: labour, cultivated area and amount of fertiliser used. The biggest share of production is consumed by the farming household and only a small share is traded on markets. Marketing revenues reduced by input costs determine the agricultural income of the region. The main negative feedback loop is caused by transport activities, which are determined by the transports necessary for subsistence, crop production and crop marketing. A rising transport burden reduces the disposable time element of the time budget. If more time is used for transport activities, less time can be spent for labour in the fields. This feedback loop establishes an equilibrium between the time needs for labour and transport. The number of working hours rises as long as enough time is disposable. Increasing labour makes the cultivation of more plots possible and leads to a bigger acreage. A positive feedback loop exists between the amount of fertiliser applied and income. Transport interventions influence the transport patterns of the household and modify the time budget, which leads to a changing production. Some of the interventions have direct impacts on the household income situation. The following assumptions are constituent for the model:

- External demand for agricultural produce is unlimited and local production does not change producer prices, which give sufficient incentives to stimulate production.
- A free transport market exists assuring the evacuation of all crops offered by the farmers.
- The sectoral division of labour does not change during the observed period.
- The time saved by transport interventions will be entirely used for direct productive or production-related transport activities.

The model simulates the process of a growing market integration of a predominantly subsistence oriented region over a period of 20 years. The initial situation assumes the complete isolation of the idealised region (Figure 7), where 20,000 people dwell. Five scenarios are set up to assess the different impacts of transport interventions.

Initially the model region is completely

Figure 6 Main features of the model



isolated and agricultural production is used to satisfy subsistence needs. The regional economy stagnates because low internal demand is not able to generate significant growth. This process is induced by the construction of a **FOOTPATH** from Village B to Market C in Figure 7. Because the market is within walking distance some villages begin to increase their production and sell crops outside the region. Disposable income increases annually by an average of 3.8%. Low construction and maintenance costs make it possible to obtain an internal rate of return of 114%. The rate seems to be quite elevated, but the initial situation with an assumed complete isolation of the region has to be taken into account⁹. It can nevertheless be stated that production is very soon restricted by the limited time requirements for long walking trips to the external market and the lack of fertiliser, which is not available without motorised access.

Thus the construction of a footpath seems to be an efficient transport intervention, if the region has no motorised access, markets are within walking distance, funds available for road construction are not sufficient, or a risk averse investment strategy is preferred.

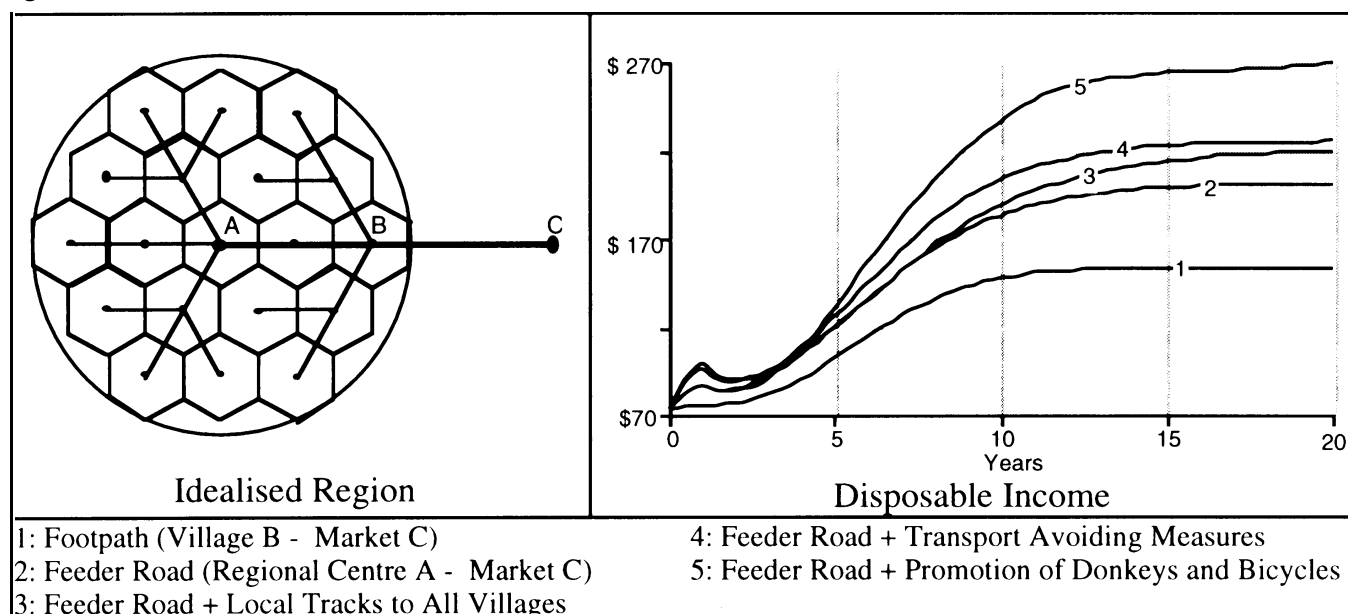
The construction of a **FEEDER ROAD** between the regional centre A and market C (Figure 7) reduces time requirements for the evacuation of crops and makes fertiliser available, both of which cause a stronger increase in production and in income than in the previous scenario. The increasing number of trips to the fields and to collection points reduces the disposable time budget

and sets limits on production. Disposable income increases by 5.2% annually. If a low cost road is built the internal rate of return amounts to 56%. Good initial conditions and the low construction costs favour a high rate of return. The construction of a feeder road is the basis for all the following scenarios and the effects always have to be regarded in relation to this scenario.

The third scenario tries to reduce the time constraints by supplying every village with motorised access. Construction of a network of **MOTORABLE TRACKS** combined with the above described feeder road causes a reduction in the transport time to markets and gives rise to another increase in production. Disposable income increases slightly faster than in the previous scenario, but due to the high investment and maintenance costs the rate of return reaches only 37%. Of course the roads would have other non-transport impacts, which cannot be monetarised here: reduced drudgery for market trips, access for ambulances and mobile health services.

In the fourth scenario the effects of **TRANSPORT AVOIDING MEASURES** in combination with a feeder road are simulated: All villages receive wells, water pumps and low consumption stoves¹⁰, which reduce the time budget for subsistence transport. Production reaches the same level as in the previous local-track-scenario, but the lower vehicle operating costs cause a slightly higher disposable income. High investment costs reduce the rate of return to 32%, which is below the previous scenario.

Figure 7 Main features of the scenarios



The biggest effects after the construction of a feeder road can be achieved by the promotion of **DONKEYS AND BICYCLES**. The main reason why farmers are nowadays not purchasing the IMT is their high price: Without any access to credit only 15% of the households would be able to purchase an IMT. The scenario simulates the effects of a revolving fund for small scale credit. A credit

financial situation in many Sub-Saharan African countries there is little hope that new rural roads can be financed by recurrent budgets. A step towards a sustainable system could be taken if village governments, wards or districts would be permitted to levy user charges under the following conditions:

- charges should be simple and inexpensive to collect,
- users pay only according to their utilisation,
- revenues should be earmarked for transport purposes, and
- a locally elected committee or institution should control the proper use of the revenues.

Revenues from road user charges are paid in a road fund, which has the task to finance maintenance costs and repay the debt for road construction (real interest rate 8%) within 20 years. The necessary user charges are listed in column 4 of Table 1. It has to be assumed that traders pass on the user charges to the farmers by reducing the producer prices of agricultural products and thus decreasing disposable income (column 5). Complete cost coverage of a feeder road would imply road user charges of \$ 4 per ton and a reduction of disposable income by 4%. In the case of the construction of motorised track access to all villages, user charges of US\$9/ton would have to be levied. This would reduce the disposable income of households by 10%. Income would reach the same level as achieved in the feeder road scenario. The question arises whether the people are willing to pay this price for reduced market transport and the non-monetary effects of the tracks. If only maintenance should be financed by the fund, then just 35% of the given charges would be necessary.

An integrated transport approach favours a combination of the above mentioned transport interventions as proposed in Figure 8. The measures are financed with a Regional Transport Fund which is a combination of the Credit Fund for IMT and the Road Fund. The fund is financed by an international credit with 8% interest rate. In the initial phases, when the region is not accessible by motor vehicles a local footpath to an external market is improved and credit is distributed for the purchase of IMT. If the farmers respond after a period of three years by

Table 1 Salient results of the scenarios

Scenario	Investments ¹¹	Without User Charges		With User Charges	
		Annual Income Growth	Rate of Return	User Charges	Reduction of Income
	\$/capita	%	%	\$/ton	%
Footpath	0.5	3.8 %	114 %	0.00	-
Feeder Road	6.0	5.2 %	56 %	4.01	- 3.6 %
Feeder Road + Tracks	15.5	5.6 %	37 %	9.27	- 9.7 %
Road+Wells + Stoves	23.1	5.8 %	32 %	3.42	- 3.4 %
IMT Fund + Feeder Road	15.0	6.7 %	58 %	2.62	- 3.8 %

coverage of 75% would give altogether 62% of the households access to IMT at the end of the simulation period. The IMT have two general effects: They reduce the transport time and they increase the productivity from decreasing to increasing returns to scale. These effects induce a strong growth in production. Disposable income increases annually by 6.7% and exceeds the growth rates of all previous scenarios. The rate of return can be estimated at 58%. The model shows, that the purchase of an IMT, even with a high real interest rate of 12%, could be very profitable for the farmers.

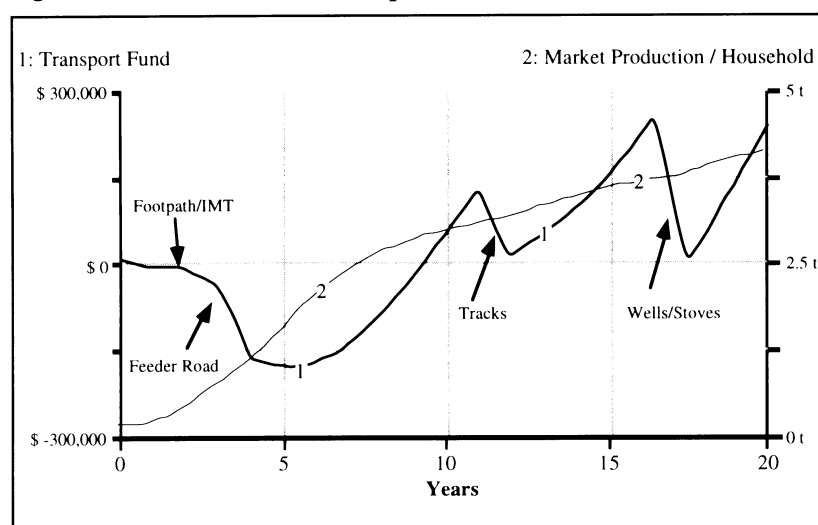
The main problems of these types of funds are high overhead costs and low repayment morale. If it is assumed that only 80% of the credit is paid back and no credit distributed to replace old IMT, the fund would reach positive values after 12 years. The Grameen Bank in Bangladesh demonstrates how the distribution of credit can be more efficiently organised. It seems to be sensible to design the credit system primarily for women in order to reduce the female transport burden. The West African savings clubs "Tontine" could be an appropriate institution.

How can Road Investments and Maintenance Be Financed?

In consideration of the desperate public

increasing their market production, a feeder road to the regional centre is constructed. After six years of simulation the total debt reaches its maximum at 9.3 \$ per inhabitant. A road user charge comprising 8% of the producer price is levied on the exported products. The growing market production enables the road users to repay the debt until year nine. Now the market production exceeds three tons and transport constraints hamper its further growth. After another two years enough user charges are collected to finance the construction of motorable tracks to every village. This investment entails another production expansion and the fund fills up faster in order to finance transport avoiding measures in year 16. After 20 years the annual market production exceeds 4.2 tonnes and disposable income reaches \$ 290, which implies an annual increase of 7.1%. The income seems to be still very low, but it has to be compared to the reality in Makete, where in 1994 the revenues amounted to less than \$ 80.

Figure 8 Succession of various transport interventions



The model shows as well, that with increasing production the investments have smaller productive effects due to decreasing returns to scale with the given technology. At the end of the simulation period new agrarian technologies, like the use of ploughs with animal traction, high yielding varieties or irrigation schemes might entail a change of the production function. A further production increase necessitates a change of the transport technology again: the evacuation of crops can be only managed with animal drawn carts or small motor vehicles.

A New Approach to Appraisal Method-

ologies of Transport Projects

The new bias towards rural transport necessitates a widening of the approaches for the ex-ante-assessment of transport interventions. HOWE (1994, p.35) judges "the current state-of-the-art for surveying and forecasting local level rural traffic demands" as "extremely crude". The concern of many studies rarely goes beyond the routine prediction of motorised traffic and growth generation. While the biggest benefits in conventional assessments are usually generated by the reduction of vehicle operating costs, the Makete Survey demonstrated that these benefits are relatively small compared to the other effects.

Therefore an appraisal of the different types of rural transport interventions should be based on a road *and* a household survey (Figure 9). The planning methodology changes from a top down view, where the region is regarded as one entity, to a bottom-up approach, where the household is the basis for the conception of transport interventions.

The road survey observes the existing motorised transport on main roads. The benefits can be derived if reduced vehicle operating costs are multiplied by expected traffic. Countries experiencing a severe shortage of foreign exchange may not be able to expand the size and usage of their vehicle fleet and therefore no extra traffic will appear. Therefore expected vehicle supply has to be taken into account if future transport volumes are estimated.

The household survey contains an assessment of household size and composition and an estimation of future population growth, migration and change in employment. The household survey gives indication of actual market production per household. The project may have direct impacts on market production (e.g. by dissemination of IMT) or reduced vehicle operating costs which give rise to future production increases (Producer Surplus Theory, CARNEMARK 1976). The household survey reveals also the actual transport patterns of rural households. The time savings per household can be achieved by reducing the number of trips and decreasing trip length. The changes in the household's transport patterns can be derived from the experience of other projects. Because IMT households have different transport patterns, the number of households possessing IMT should be estimated. Direct income effects

can be assessed by wages paid during the construction phase.

European cost/benefit calculations for road investments include a monetary value for time savings and reduced accidents. Time savings can be valued with the opportunity costs of time. In the case of Makete the marginal productivity of labour was chosen as the basis for the valuation.

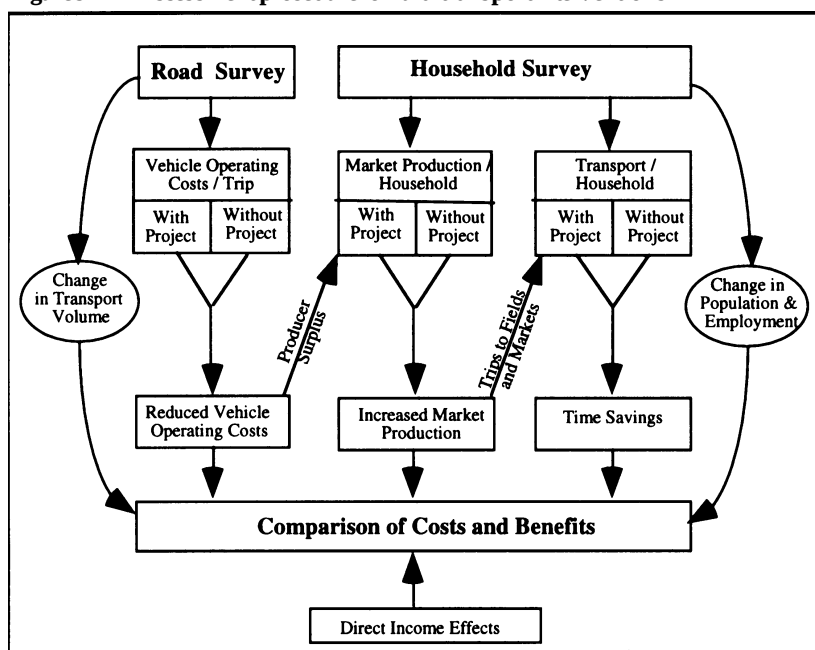
The empirical evidence from many studies about the impacts of road improvements¹² shows that the estimation of production and marketing changes is related to strong uncertainties. The low reliability of the predictions favours risk averse investment strategies:

- Choice of the cheapest investment opportunity related to the local needs: In an initial development phase the improvement of footpaths or construction of motorable tracks might be more appropriate than a wide feeder road.
- Spatial distribution of investments: Build as cheaply and extensively as possible or undertake spot improvements on existing roads and wait for a response from producers. If bottlenecks occur, then further investments can be warranted in the responding regions.
- Choice of labour intensive construction methodologies in order to distribute the direct income effects more equally among the local population.
- Leave the risk assessment to the produc-

ers: A small scale credit system delegates the decision about the productive effects to the farmers. Probably the individual appraisal of the farmers is more reliable than the global assessment of a highly educated planner.

An eurocentric transport planning approach, which focuses exclusively on motorised transport, does not reflect the production constraints of African rural households. The improvement of the local transport system in and around the village can set forces free which stimulate economic development. Reduced effort and drudgery in transport, decreasing time constraints and better access to public facilities and markets will most probably entail an expansion of agricultural production. Intermediate Means of Transport can increase agricultural productivity, reduce rural isolation and thus raise the acceptance of agricultural innovations. Transport improvement for rural households is an important precondition for a dynamic rural development process.

Figure 9 Assessment procedure for rural transport interventions



Footnotes

- ¹ This article relies on the PhD-Thesis: SIEBER, Niklas (1996): *The Contribution of Transport Investments to Regional Development in the Rural Areas of Sub-Saharan Africa*, Karlsruhe.
- ² UNCTADA II, The Republic of South Africa is excluded.
- ³ AIREY (1992), BARTH/ HEIDEMANN (1987), BARWELL (1993), BARWELL / EDMONDS / HOWE / DE VEEN (1985), BARWELL / DAWSON (1993), HOWE / RICHARDS (1984), KAIRA (1993), RIVERSON / CARAPETIS (1991).
- ⁴ BARWELL / MALMBERG (1989)
- ⁵ The remaining eight hours are spent sleeping.
- ⁶ Title of the book by BARWELL and DAWSON (1993)
- ⁷ The benefits from reduced Vehicle Operating Costs are not listed here, because it is assumed they are included in the benefits by increased market production. Compare: ADLER (1987, p.34)
- ⁸ The direct income effects are high, because a labour based construction technology was chosen. Compared to capital based technology the labour

based approach increases the share of wages on total expenditure, reduces the financial costs and the need for foreign exchange. (RIVERSON et al 1991, HERTEL 1991, ILO)

⁹ Probably the model overestimated the production increase for the footpath scenario, because no functional relation between distance to the market and market production could be implemented. The long walking distance would probably set stronger restrictions than in the other scenarios.

¹⁰ It is assumed that wells have the same effects as the water pipes observed in Makete. Low consumption stoves reduce the consumption of firewood by 40 %.

¹¹ Regular Maintenance expenditure is excluded. The necessary money to fill up the credit fund for IMT is added to the total investments.

¹² A comprehensive overview of various transport studies is given in HOWE / RICHARDS (1984) and in WILSON (1973)

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Solving Bangkok's Transport Woes: The Need to Ask the Right Questions

Peter du Pont and Kristina Egan¹

1 Introduction

Bangkok is a city in transportation crisis, and the impacts of its traffic problem are gradually impinging upon all aspects of life — environmental quality, human health and psychology, economic productivity, energy use, and human mobility and quality of life. Solutions exist to Bangkok's transportation problem, and they have been mapped out in a growing body of consulting studies and academic papers over the past 20 years. At present, the Thai government is embarking on a crash course of expressway and mass-transit projects which — although they have encountered numerous delays — will begin to yield results during the second half of the 1990s. Although these "megaprojects" may provide some relief for the traffic crisis, it is doubtful that they will significantly improve human transport, environment, and health conditions in the city.

The notable aspect of the transportation plans and studies that have been conducted to date in Bangkok is that they have all been conceived and written from an economic/engineering perspective. These studies, which have been conducted by Western and Japanese consulting firms, have focused on the technical issues of how to manage traffic. Although a passing nod has been given to the need for institutional reform in order to implement policies, this aspect of the problem has been almost completely overlooked. The basic barrier, as many have pointed out, is the ability to develop a political consensus that will permit the implementation of a coordinated set of policies to deal with the problems. Yet how might Thai policymakers move toward the development of such a consensus? And is there a role for outside analysts and researchers in providing Thai policymakers with information that could assist in the policymaking process?

Social science research could provide new insights into Bangkok's traffic crisis by asking a different set of questions than those typically posed by both Thai and foreign transportation experts. For example, instead of asking "Which are the four best policies to relieve congestion?" or "What combinations

of roads and transit will satisfy future transport demand?", we might ask "What institutional factors have slowed or limited implementation of the recommended transport schemes?" or "What set of actions do Thai bureaucrats and politicians think will most effectively deal with the current problem?"

This paper summarizes the current status of the transportation situation in Bangkok and proposes a research agenda that could further understanding of the barriers to implementation of an integrated transport plan. The proposed research would assist policymakers as they grapple with the essentially political problems of retrofitting transportation solutions into a severely congested megacity. The first section of our paper deals with the current status of Bangkok's transportation system, drawing on a number of recent studies that have documented the problems and offered myriad sets of policies to deal with the problems. We then summarize several studies that have been undertaken to compare transportation policies in Bangkok with policies being implemented in other Asian cities, in order to place its transportation problems in a regional context. A subsequent section describes the status of the three megaprojects being undertaken to alleviate the city's traffic congestion. We conclude by discussing the role that social science research could play by identifying critical attitudinal and institutional issues that must be addressed in order for Thai political leaders to deal effectively with the transportation crisis.

2 Bangkok's Transportation Crisis

2.1 Population

Bangkok is typical of other "megacities" in Asia (e.g., Jakarta, Manila, Delhi) that are unable to expand their infrastructures to keep up with the pressures of rapid population growth. More than half of the world's urban population increase is occurring in Asia (Pendakur 1993). The population of the Bangkok Metropolitan region is currently increasing at a rate of 2% annually and has more than doubled — to

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World Transport Policy & Practice
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nearly 6 million — in the last 25 years. There is no other similar urban magnet in Thailand — the next largest metropolitan centre, Nakhon Ratchasima (Khorat), has a population of less than 300,000.²

2.2 Vehicle Ownership

Bangkok's transportation problems also reflect the systemic problem inherent in the traditional pattern of development. As incomes rise, people purchase their own private vehicles, and the existing road infrastructure is unable to handle the resulting traffic load. In Asia, car ownership is increasing at a rate of 6-20% each year, while motorcycle sales are increasing by 10-30% annually (Pendakur, 1993).

Bangkok has 15% of Thailand's population and more than three quarters of the privately registered automobiles (see table 1). Given current motorization trends, the problem is destined to get worse before it improves — new vehicles are being added to the

A major factor contributing to the increased usage of private cars is that Bangkok's mass-transit system is inadequate. Although 65% of Bangkok travellers use buses, private cars rule the roads, and buses use just 10% of the road space on average. Although Bangkok has more than 100 km of bus lanes, there has been no successful effort to establish barrier-separated bus lanes (also called "busways") — a strategy that has successfully reduced congestion in many other cities (Guruswamy 1994). The three megaprojects under construction will add rail-based mass-transit systems into the city — two elevated rail systems and a subway — but these will not be completed for several years.

There is some discrepancy over projections for growth in the amount of vehicle activity in Bangkok. Three major studies have made projections for the period 1989 to 2006. Estimates of the number of motorized trips per day in 1989 range from 12.7 million to 25.5 million (JICA, 1990; Halcrow, Fox *et al.*, 1991; and TDRI, 1990). Projections for 2006 range from a low of 21.5 million to a high of 43 million daily trips. The reports by JICA, and Halcrow & Fox *et al.* agree that the percentage of trips taken on buses will remain constant at about 39%.

2.3 Transportation Infrastructure

Most analysts contend that a major limitation in Bangkok's ability to handle a large and increasing number of private motor vehicles is the low proportion of road area. Roads cover just 8% of Bangkok's land area, compared to 20-25% in cities like London, Paris, and New York. However, Poboon (1994) disputes the importance of increased road provision.⁴ Bangkok's existing roads are not adequately configured to handle existing traffic flows, and there are a lack of secondary roads connecting the major arteries. This causes an estimated increase of up to 30% in the number of vehicle kilometres traveled and exacerbates congestion on the major arteries. (Sayeg *et al.*, 1992).

2.4 Current Traffic Situation

Traffic has become intolerably slow in the central business district of Bangkok. It is difficult to schedule more than 2 meetings per day, and it often takes 1-2 hours to get just part way across town. It has been estimated that the average Bangkok resident spends the equivalent of 44 working days in traffic each year, and that the lost productivity — US\$9.6 billion — is

Table 1 Vehicle Registrations in Thailand, by type.

Type of Vehicle	Bangkok	Whole Country
Motorcycles	729,000 (36%)	4,778,000 (63%)
Private Cars	598,000 (29%)	777,000 (10%)
Private Buses	301,000 (15%)	445,000 (6%)
Pick-up Trucks	269,000 (13%)	926,000 (12%)
Trucks	68,000 (3%)	331,000 (4%)
Buses	21,000 (1%)	72,000 (<1%)
Other (taxis, tuk-tuks, etc.)	60,000 (3%)	263,000 (3%)
Total	2,046,000 (100%)	7,592,000 (100%)

Source: Thailand Department of Land Transport in Sayeg *et al.* 1992

roadways at a rate of more than 800 per day, or 300,000 each year³ (Sayeg *et al.*, 1992).

Table 1 shows the breakdown of motor vehicles by type for Bangkok and for the entire kingdom for 1990. The table shows, among other things, that the overwhelming majority of vehicles in Bangkok are privately owned. The rapid increase in Bangkok's automobile fleet over the past 40 years is shown in table 2. The increase was particularly high — nearly four-fold — during the 1980s, and this trend has accelerated since the import duty on automobiles was dramatically reduced in 1991.

Table 2. Increase in Bangkok's Vehicle Fleet

Year	1947	1960	1970	1980	1990
No. vehicles	6,000	70,000	275,000	570,000	2,000,000

(Source: Poboon *et al.*, 1994)

equivalent to about 10% of Thailand's GNP (Sayeg *et al.*, 1992).

Average vehicle speeds during peak hours in the central business district are 6-10 km per hour. In the areas outlying the central business district, vehicles move faster, around 18 km/h. At the city's worst intersection⁵, it can take up to 45 minutes just to travel 600 metres (Pendakur 1993).

In addition to the large and increasing number of vehicles and the limited road space, two factors contribute to Bangkok's traffic problem: lack of government coordination and poor traffic signal management. The Traffic Engineering Department manages traffic signals while the Department of Public Works manages the development of public infrastructure (i.e. roads). Although there are plans to install a computerized system to manage the traffic signals, the signals are currently manually controlled by the police.⁶ The police contribute to the traffic congestion problem by operating the lights on cycles of up to 10 minutes, compared to the normal cycle of about 2 minutes in other countries (Sayeg *et al.*, 1992).

2.5 Impacts of Transportation System

The impacts of Bangkok's traffic congestion include lost economic productivity, human health impacts (some of which are quantifiable) and environmental health impacts (most of which are not quantifiable). As mentioned above, a rough estimate of lost human productivity due to wasted time in traffic is \$9.6 billion. However, this figure only accounts for the value of lost work time, and does not account for increased stress and mental illness as well as a deteriorating quality of life. Table 3 lists some of the major economic and health impacts.

2.5.1 Environmental and Human Health

Table 3. Economic and Health Impacts of Bangkok's Traffic Crisis

Economic Impacts	
• \$9.6 billion / year in lost work productivity	
• \$1.6 billion worth of energy / year wasted idling in traffic	
• Millions of dollars / year in health bills	
Health Impacts	
• CO and particulates exceed WHO standards	
• 42% of traffic police suffer from respiratory diseases (asthma, conjunctivitis, lung cancer)	
• 1 million respiratory infections / year linked to air pollution	
• Bangkok has lung cancer rates 3 times higher than other areas of Thailand	
• elevated child blood lead levels (3 times WHO guidelines)	
• many nervous disorders associated with traffic stress	

Source: Sayeg *et al.* 1992

Impacts

Pollution levels on Bangkok streets have been widely studied and reported in the literature (Pendakur, 1993; Sayeg *et al.*, 1992; TDRI, 1990). Levels of carbon monoxide and suspended particulate matter far exceed safety guidelines set by the World Health Organization. One source estimated that 8-hour exposure at street level is equivalent to smoking 9 cigarettes per day (TDRI 1990).

Until the government offered tax incentives for the sale of unleaded gasoline in early 1991, airborne lead was a serious problem. Since that policy was implemented, sales of unleaded gasoline have increased dramatically and average airborne lead levels are now below the Thai standard (TEI 1994). Nonetheless, blood lead levels of children living in one densely congested area of Bangkok near the expressway ranged from 150-180 Mg/l (microgrammes per litre), significantly higher than the WHO guideline of 10 Mg/dl (Pendakur 1993). In short, the problem of lead poisoning exists, but it is expected to decrease in the future as the amount of leaded gasoline used in Thai automobiles declines.

The biggest transport-related health impact is due to suspended particulate matter (SPM). The World Health Organization guideline for 24-hour ambient mean levels is 230 Mg/m³. Readings in Bangkok often exceed 500-600 Mg/m³, and more than 60% of the SPM is smaller than 10 microns in diameter, which means it can easily penetrate into the lower portions of the lungs and cause greater damage. A study of 1,758 traffic police concluded that more than 40% suffer from respiratory diseases, including asthma, conjunctivitis and lung cancer (Pendakur, 1993).

2.5.2 Energy Impacts

The cost of the energy wasted while vehicles idle in Bangkok's horrendous traffic jams has been estimated at about \$1.6 billion per year (Sayeg *et al.*, 1992; Poboorn, 1994). Clearly, solving the traffic congestion problem would have substantial energy benefits,⁷ and this would translate into significant monetary savings for the public and a reduction in the country's fuel bill for the import of petroleum. Bangkok consumes 40% of all of Thailand's fuel for road transport, and most of this is in the form of imported fuels (Sayeg *et al.*, 1992).

Substantial energy and cost savings could be achieved even without tackling the

congestion problem. Currently, there are no fuel economy standards for vehicles sold in Thailand. The Thailand Development Research Institute (TDRI) has reported that typical Thai automobiles in the mid-1980s used 11 litres/100 km. TDRI estimated that increasing fuel economy to a level of 8 litres/100 km would reduce automobile energy use by 20-30%.⁸ TDRI proposed that this could be achieved by a combination of government mandated fuel economy standards and an increase in fuel prices (TDRI, 1990).

3 What Can be Learned from Comparative Studies?

Comparative international studies can provide Thai policymakers with valuable information on policies and schemes that have worked elsewhere. In many cases, strategies that have succeeded in other countries could be adapted and implemented in Bangkok. However, the problem for Thai policymakers is not one of finding solutions, but rather of developing a political consensus and organizational framework that can lead to the selection and implementation of a coherent set of policies. Nonetheless, a brief review of some comparative studies can help to place Bangkok's traffic problems in a broader context.

3.1 Singapore

Several recent studies of transportation in Asian cities have focused on the successes of transportation policies in Singapore as compared to its fast-growing neighbors: Jakarta, Bangkok, and Manila. At least two studies have used the comparison between Bangkok and Singapore to highlight the difference that an authoritarian governmental structure can make in the development and successful implementation of transportation policies (Guruswamy, 1994; Tanaboriboon, 1993).

3.1.1 Limiting Automobile Usage

While neither Guruswamy nor Tanaboriboon examined the organizational and institutional factors that make for a successful transportation planning effort, they itemized the specific initiatives that Singapore — in contrast to Bangkok — has been able to implement to discourage private automobile usage.

- **Buying a car is expensive.** In Singapore, 75-80% of the cost of purchasing a car consists of the import duty, registration

fee, title fee, and other taxes and fees. In contrast, Thailand in 1991 lifted the ban on importing fully assembled, small-engine cars and dramatically reduced the import duties on small cars from as high as 300% down to 20-30% (Poboon *et al.*, 1994).

- **Operating a car is expensive.** Gas in Singapore costs \$2.80 per gallon — twice as much as in Bangkok — and the monthly cost of operating a car is estimated at \$400.
- **Area licensing scheme.** A Singapore government committee recommended an area licensing scheme in 1973, and it was implemented by the government in 1975. Traffic data show that, while the number of cars doubled between 1975 and 1991, the amount of daily traffic in the restricted zone has declined dramatically, thus reducing congestion (Guruswamy, 1994).
- **Electronic road pricing.** Singapore recently began testing an electronic road-pricing system that relies on a technology that automatically charges motorists for the use of roads in the central city zone. Singapore has thus become the world leader in this technological approach.
- **Weekend car category.** Singapore has introduced a registration category for "weekend cars", which receive a substantial discount on their vehicle registration fee. Weekend cars can only be used between 7 pm and 7 am on weekdays, after 3 pm on Saturdays, and all day on Sundays.
- **Other policies.** The Singapore government has enacted additional policies to discourage car ownership and use. These include a 45 mile-per-hour speed limit, a difficult and lengthy procedural requirement to obtain a driver's license, and the high price of using parking garages (many of which are government owned).

In contrast to this array of policies that Singapore has adopted to discourage car use, the Thai government has not initiated a single policy to establish such disincentives. The institutional reasons that may explain such lack of action are discussed later in this paper.

3.1.2 Providing Adequate Mass Transit

As noted earlier, the mass-transit system in Bangkok is not well developed: there have

been several unsuccessful efforts to establish separated bus lanes in Bangkok, and elevated rail and subway systems are currently under construction. Singapore, by contrast has a mass-transit system that carries nearly 70% of all passengers to and from work in a timely fashion. The mass-transit railway is financed largely by automobile taxes, which generated \$400 million in revenues in 1990. The automobile taxes in Bangkok are significantly lower and generate correspondingly less revenue (Guruswamy, 1994).

3.2 Other International Comparisons

Newman and Kenworthy (1989) have carried out the most comprehensive international comparison on urban transportation systems. Over a two-year period, the authors visited 31 cities and collected a standardized set of data that allows comparison across a range of indicators. In a follow-up to this study, they teamed with a Thai researcher to collect a similar data set for Bangkok and, given an historical understanding of the development of the Thai transportation infrastructure, explain the current Thai traffic crisis. A few of their findings are illustrative:

- Transportation in Thailand makes up a much higher percentage of total energy demand than other Asian countries (56% in Thailand, compared to 36% in Malaysia, 30% in Indonesia, and 15% in Korea.)
- Bangkok's rate of car ownership is similar to that in East Asian countries with a per-capita income many times higher than Bangkok. Bangkok residents own 200 cars per 1,000 inhabitants, compared to 225 per 1,000 in Tokyo, 101 per 1,000 in Singapore, and 43 per 1,000 in Hong Kong.
- Although Bangkok has one of the lowest percentages of road area (8% versus 20-25% for London, Paris, and New York), and is thus structured against car use, it provides a level of parking spaces that is similar (on a proportional basis) to automobile-centred U.S. cities such as Houston or Detroit.
- Policies that rely on building more roads to limit congestion are doomed to failure. Bangkok's road network is 3,780 kilometres in length. With 800 new cars being registered each day, this adds up to a 1,400-km-long line of new cars being added to the vehicle fleet each year.⁹

- Bangkok's infrastructure discourages non-motorized modes of transport; for example, there is a lack of sidewalks and no bicycle lanes. Only 10% of work trips are made on foot or by bicycle, compared to 25% for wealthier Asian countries and an average of 22% for European countries.
- Given Bangkok's limited amount of road area, its public transport system is not adequate. Thirty percent of total passenger miles travel in Bangkok are on public transport, compared to an average of 64% for wealthier Asian cities. Poboon *et al.* (1994) conclude that: "Traffic jams in Bangkok are therefore inevitable because they are attempting to carry too little passenger travel on public transport relative to their provision of roads."

Other comparative international research has highlighted successful traffic management strategies that — given the political will — could be applied in Bangkok. For example:

- In Mexico City, automobile use is restricted to five days a week, using a system of different-colored license plates (Pendakur, 1993).
- Jakarta in early 1992 required all cars on main roads to carry at least three people. The policy was repealed later the same year when the courts ruled it illegal (Pendakur, 1993).

Another study compared the transportation infrastructures in four Asian cities at different stages of development: Bangkok; Surabaya, Indonesia; Varanasi, India; and Islamabad, Pakistan (Birk and Zegras, 1993). Because of the differences among the cities' transport systems, it is difficult to translate successful strategies from the other cities to Bangkok. However, unlike most other studies, Birk and Zegras studied the most critical element in developing a successful transportation strategy: the existence of a government institution with the ability to implement all decisions that will affect the city's transportation system.¹⁰ Of the four cities studied, only Islamabad has an implementing body with the authority to control and coordinate transportation planning. The study concluded that Islamabad's implementation adheres to the city's Master Plan, and that the city's transportation problems relate more to the content of the policies themselves rather than to their implementation (Birk and Zegras, 1993).

4 History of Bangkok's Transportation Plans

Table 4 presents an overview of the transportation plans that have been drawn up for Bangkok since 1960; none of these plans have actually been implemented. A key theme of this paper is to explore the reasons for a continuing lack of effective political action, especially in the face of growing traffic congestion and occasional "gridlock" events, when the entire city becomes paralyzed for several hours at a time. One of the more comprehensive recent assessments of the transportation situation in Bangkok proposed a set of policies with this caveat:

"The problem, therefore, is not coming up with proposals on how to alleviate Bangkok's transportation crises, rather the dilemma is choosing the most appropriate of the proposals and ensuring their implementation and follow-through ... Whether [this] or any other plan is actually implemented depends on institutional commitment and will, the lack of which has plagued all attempts to change Bangkok so far." (Sayeg et al., 1992)

This statement is clearly accurate, and it reveals the weakness of the engineering/

economic approach that has been used to analyze Bangkok's traffic woes. Numerous consultants have proposed technical fixes for Bangkok's traffic congestion problem; but none has attempted an in-depth study of the institutional barriers that have prevented effective action while the traffic situation has deteriorated to its present state.

5 Status of Current Policies

5.1 Roles of the Public and Private Sectors

5.1.1 Government Reliance on the Private Sector

Since the late 1980s, the basic approach of the Thai government in transportation planning has been to rely on private-sector investment. This strategy relieves the government of a large financial burden and transfers this risk to private-sector firms, which usually bid for the projects in the form of consortia. The private sector is motivated by profits that it can accrue through operation of a transport concession, real estate development along transport corridors, and by tax incentives and "tax holidays"¹¹ provided by the government.

The trend has been away from government

Table 4. Overview of Bangkok Transportation Plans — 1960 to Present

Year	Plan/Initiative	Description
1960	Litchfield Plan	Designated land use in concentric rings of development. Never formally adopted or actually implemented. Partially as a result of the Litchfield Plan, the Department of Town and Country Planning (DTCP) was established in 1961-2 under the Ministry of Interior.
1969	Updated Litchfield Plan	Prepared by City Planning Division of the Bangkok Municipality. Prior to this, the City Planning Division did not have jurisdiction for such a plan. Outlined different land-use patterns and road configurations than the earlier Litchfield Plan and the 1971 DTCP update of the Litchfield Plan (see below). Never taken beyond paper stage.
1971	Updated Litchfield Plan	Prepared by DTCP. Differed little from the original Litchfield Plan. Expanded overall development area and adjusted the 1990 target population from 4.5 million to 6.5 million. Stressed development of the road network to accommodate growing traffic congestion. Never taken beyond paper stage.
1975	Town Planning Act	Passage of this act required another revision of the Litchfield Plan. The revised plan was called the Greater Bangkok Plan 2000 and was prepared as part of the 4th National Economic and Social Development Plan (NESDP) for 1977-1981. The plan proposed a polycentric development model and adjusted the 1990 target population to 7.5 million. It was revoked in 1978 due to opposition to its proposal to decentralize the city administration.
1982	BMA Structure Plan	Prepared as part of the 5th National Economic and Social Development Plan (NESDP) for 1982-1986. Plan aimed to slow down Bangkok's physical growth through land use planning, zoning regulations and targeted investments. Plan did not provide any government agency with the legal authority to implement the plan. The transportation component of the 6th NESDP (1987-1991) had the same shortcoming.
1992	7th National Plan	The 7th NESDP placed most of its emphasis for solving Bangkok's transportation problems on the financing and construction of two large mass-transit projects by private sector firms—the Hopewell project, which would combine an expressway with light rail service; and the Skytrain project (later called the Tanayong Elevated Rail project), which would provide an elevated light rail system. The Plan emphasized coordination of existing and planned expressway projects; called for road pricing as a tool to manage transport demand and a "Regional Structure Plan" to guide development. As with previous plans, the 7th National Plan lacked detailed planning regulations and proper enforcement authorities.

Note: Table adapted from Sayeg et al. (1992). None of these plans have ever been wholly, or even mostly, implemented.

purchase of — or contracting of — private-sector services and toward a much greater role for the private sector in the conception and design of projects. The benefit of such an approach is that it can relieve the government of much of the financial burden of raising capital for expensive road and mass-transit infrastructure projects. For example, the Hopewell Company is financing, building, and operating a \$3.2 billion elevated road and rail project for the Thai government. When this project was considered by the Thai Cabinet in 1990, private financing and the expected quick construction time were seen as two of its biggest benefits.

At the same time, such reliance on the private sector has several drawbacks. Projects can be driven by the needs of the private sector rather than the public good. This drawback is reflected in the lack of equity in the allocation of funds for the transportation infrastructure: two-thirds of spending is on roads and one-third on mass-transit projects (Poboon *et al.*, 1994). In the case of Hopewell, the government conceded railroad rights-of-way for construction of the project in Bangkok; granted land along the rights-of-way for the development of real estate projects along the rail corridor; and gave the company a multi-year tax holiday on the profits from these real estate developments. Another drawback is the lack of integration between the transit megaprojects. Several legal wrangles have held up implementation of the megaprojects, and most of them stem from the fact that the projects were separately formulated in the absence of an overarching, operational master plan.¹²

5.1.2 Status of the Megaprojects

Table 5 summarizes the three major mass-transit initiatives in Bangkok. In addition to

the three megaprojects listed in the table, the government is pursuing four major expressway projects and a crash program to build overpasses at 18 of the city's most congested intersections (most of which have been completed). As noted above, the current mix of projects has resulted from the government's *ad hoc* policy of entertaining bids from the private sector rather than developing a comprehensive set of integrated transport plans and then putting these projects out to bid.

Recently, some factions within the government have begun to question some of the contract provisions signed by previous governments and have taken steps to gain control of the transportation planning process. Such steps include threatening to take over projects if the private sector firms delay implementation;¹³ increasing pressure on developers to build their megaprojects underground in the city centre, and the approval in September 1994 of a Bangkok Transit Master Plan which includes two new mass-transit routes totalling 77 km in length (*Bangkok Post*, 21 October 1994).

By relying on the private sector to plan and finance the three mass-transit megaprojects, the Thai government hoped to avoid burdening itself with debt. Unfortunately, questions about contractor ability to finance the projects, delays, and conflicts between the contractors have instead burdened the government with headaches.

Only the construction of Tanayong's elevated rail is proceeding according to schedule. The Hopewell elevated rail and road system, slated for completion by the 1998 Asian games, is less than 10% complete (Wancharoen, 1996). Many believe that Hopewell's inability to complete its northern route by December 1995, as promised, is indicative of the firm's lack of commitment

Table 5. Status of Bangkok's Transportation Megaprojects

Project	Financing	Mode(s)	Length/Cost	Status
Hopewell	–Thai-Hong Kong joint venture –30-58-yr concession	–elevated road –commuter train –light rail	–\$3.2 billion –60 km tracks –40 km roads –80,000 pass./hr in each direction	–9.3% complete ^a –target to complete by '98 Asian games
Tanayong Elevated Rail^b	–Thai-foreign joint venture –30-yr concession	–elevated train	–\$1.12 bn –23.7 km tracks –700,000 pass./day	–target to complete by late 1998
Mass Rapid Transit Authority (MRTA)	–Thai-foreign joint venture –30-yr concession –35-yr management	–subway	–\$2.4 bn –20 km subway –80,000 pass./hr	–in planning stage –plan to begin construction in 1997

^aAs reported by Wancharoen (1996) ^bAlso called the Bangkok Transit System Corporation project

to the project. Indeed, a recent investigation revealed far less construction equipment and fewer laborers present at construction sites than is required for such a project (Wancharoen, 1996). In addition, Hopewell has had serious difficulty securing financial backing for the project.

The subway project of the Mass Rapid Transit Authority (MRTA) has also experienced delays, although in this case they have been due to government changes to the project design and the financing plan. Originally, the MRTA mass-transit project was designed as an above-ground system, and was to be undertaken by Bangkok Land Co. However, in 1994, the MRTA ordered half the route underground. Later, in 1995, the order extended to the whole system, and the government — via MRTA — took over the project. In addition, MRTA decided to privately finance only the operation of the electric trains, rather than the design of the system. With so many changes, the lack of applications from qualified subcontractors is not surprising. The project promises to continue to be a political football since the party of the former Deputy Prime Minister who backed the project recently left the government coalition. His departure once again put the basic design of the system into question. Another point of contention is the coordination of junctures between the Hopewell system, the Tanayong elevated rail and the MRTA subway.

5.2 Institutional Issues

5.2.1 The Existing Regulatory Confusion

There are more than 30 government agencies with responsibility for transport and urban development of Bangkok. In practice, however, the implementation of transport and land-use plans are carried out by 11 agencies which fall under two ministries — Interior and Transport & Communications (see Table 6).

“There are a number of key problems with existing institutional arrangements including the large number of overlapping agencies, the lack of effective coordination and monitoring of other agencies' activities, the lack of staff trained in transportation and urban planning development, and an outdated administrative and legal framework within which to implement the proposals. The long-term nature of many transport projects, such as construction of a mass-transit system, tends to lower agency staff and morale.” (Sayeg et al., 1992)

The case of the Second-Stage Expressway illustrates the potential dangers of the current bureaucratic confusion in the area of transport planning. A Thai-Japanese consortium, the Bangkok Expressway Company, Ltd. (BECL), contracted with the Thai government to construct and operate the Second-Stage Expressway. Just prior to the opening of the first stage (12 km) of the expressway in early 1993, the Thai Cabinet reneged on its contract with BECL by only permitting the firm to collect a toll fee of \$0.80, rather than the \$1.20 fee stipulated in

Table 6. Agencies Implementing Transport and Land-Use Plans in Bangkok Metropolitan Area

Agency or Committee	Reports to:
Bangkok Metropolitan Administration (BMA)	Ministry of Interior
Bangkok Mass Transit Authority (BMTA)	Ministry of Transportation and Communications
Department of Highways	Ministry of Transportation and Communications
Department of Land Transport	Ministry of Transportation and Communications
Public Works Department	Ministry of Interior
Department of Town & Country Planning	Ministry of Interior
Expressway and Rapid Transit Authority (ERTA)	Ministry of Interior
Harbor Department	Ministry of Transportation and Communications
Office of the Committee for the Management of Road Traffic (OCMRT)	Ministry of Interior
State Railway of Thailand (SRT)	Ministry of Transportation and Communications
Traffic Police Division, under Metropolitan Police	Ministry of Interior

Source: Sayeg et al. (1992) Note: acronyms are provided only where they are commonly used to refer to the agency.

the contract. For more than three months during mid-1993, BECL refused to open the expressway. Finally, with city traffic becoming increasingly congested, a Thai court forced the company to open the expressway, a move which brought temporary relief to many traffic-weary Bangkok residents. However, the whole episode seriously damaged the credibility of the Thai government in the eyes of the foreign investment community, which is expected to provide much of the future investment in Bangkok's transportation infrastructure.

One bright light during 1994 was the short life of Traffic Crisis 94 a non-governmental body established in early 1994 to provide the government with an action plan to deal with the ever-worsening traffic situation. The group was convened by Anand Panyarachun, a highly regarded former prime minister, and comprised members of the private sector, government officials and members of citizen's and community organizations. The group's highly publicized report contained a prioritized list of 62 action items to alleviate the traffic crisis.¹⁴ The action plan was not implemented by the government, however, and by mid-1994, Traffic Crisis 94 had disbanded. While the group's recommendations provided a specific and limited set of objectives, it did not address the fundamental institutional issues which have hindered the Thai government's ability to adopt and implement a comprehensive plan to reduce traffic congestion. Nonetheless, the birth and death of Traffic Crisis 94 set a promising precedent of citizen participation in transportation planning.

5.2.2 The Attitudes of Thai Policymakers

There is a consensus among Thai decision-makers that Bangkok is in the midst of a serious and worsening transport crisis. One characteristic of the current situation is what

we call the "silver bullet" theory. There seems to exist a belief among government officials responsible for transport policy that completion of the 3 current mega-projects (Hopewell, Tanayong elevated railway, and the MRTA subway) will solve Bangkok's current traffic woes. Unfortunately, this prevalent optimism has the effect of forestalling other complementary demand management measures which could currently be undertaken to help relieve Bangkok's traffic congestion and to reduce the associated energy, environmental health, and economic impacts.

In fact, the road map to solving Bangkok's traffic congestion exists — on paper. The scores of consulting reports that have been completed agree on the basic menu of policies that need to be implemented in order to improve Bangkok's transportation services. Some of these are listed in Table 7. Unfortunately, the lack of government ability to coordinate and build a consensus for a comprehensive set of specific policy measures has received little serious study and analysis. The following statement is typical of the hand-wave approach taken to institutional issues by most of the consultants who have studied Bangkok's transportation system:

"Since the problem does not seem to be lack of plans or proposals for navigating Bangkok out of its difficulties, it seems that institutional barriers to controlling Bangkok's development are [the problem]." (Sayeg et al. 1992)

5.3 A Proposed Research Agenda for Bangkok

The many engineering and economic studies that have been conducted for the Thai government have assumed that politicians, given a set of clear policy options, will act upon a common set of assumptions and maximize societal gain. Clearly, in the case of Bangkok, this assumption is false. At both the individual and organizational levels, political actors are making decisions that maximize their own interests. There is thus a constant conflict over purposes and an ongoing process of bargaining between the actors.¹⁵ In the case of Bangkok, the main actors are the different ministerial agencies and the political parties that control them.

In order to have an impact on policy development in Bangkok, further research should focus on three primary areas: examining the gap between stated

Table 7. Basic Set of Policies Identified to Solve Bangkok's Traffic Crisis

- Improve vehicle technology
- Inspect and monitor vehicles
- Promote alternative and cleaner fuels
- Implement Area Traffic Control system
- Implement comprehensive land-use plan
- Road-area pricing
- Mass transit rail systems
- Separated bus lanes
- Additional roads and expressways
- Education and awareness

Adapted from Sayeg et al. (1992)

government policy and actual implementation; understanding the culture of the Thai governmental bureaucracy; and assessing the role of outside organizations, and their influence on government decision-makers. An additional area of research that might be fruitful is the study of transit planning authorities in other countries.

5.3.1 Gap Between Planning and Implementation

A first step toward critically examining government transportation policy, is to measure the alignment of public policy goals with actual implementation. The Seventh National Economic and Social Development Plan (1992-1996) outlines a variety of objectives for government transportation policy. These included construction of two mass-transit schemes; co-ordination of future and planned expressways with roads and car parking; road pricing and other measures to manage transport demand; strengthening of the Bangkok Metropolitan Administration's planning authority; and the development of an "authoritative" Regional Structure Plan to guide development. This phase of the research would systematically compare the objectives of the Seventh Plan with the results achieved to date. It will also serve as the basis for later interviews with the main actors in Bangkok's transportation sector: the Thai bureaucracy, politicians, and outside organizations.

5.3.2 The Culture of the Thai Governmental Bureaucracy

The Thai governmental bureaucracy was developed by King Rama V during the late 1800s, and it quickly mushroomed in size and power to become a significant force in Thai society. In order to understand the role of the various government agencies responsible for transport, it is necessary to explore the assumptions and attitudes of the bureaucrats. How do the government officials get their information? What motivates their decision-making? What types of behavior are rewarded by promotion? What types of behavior and decisions are considered risky?

This investigation should be carried out in two steps. The first part would involve a comprehensive study and analysis of the literature. The next step would be a series of semi-structured interviews with top ministry officials designed to gain an understanding of how the "elite" develop their framework of social policy problems and solutions. To

complement these interviews, a series of interviews should also be conducted with a handful of actors who are outside the bureaucracy but who, along with the bureaucrats, play a key role in policy development and implementation — e.g., politicians, academics, and transportation consultants.¹⁶ The combined results of these interviews could provide crucial insights not only into the motivations and decision-making behavior of policymakers but also into the common areas of interest where development of a political consensus might be possible.

5.3.3 Influence of Outside Organizations

A final piece of the research puzzle is to examine the influence of external organizations on the policymaking process. The significant role of the private sector has been demonstrated earlier: the most ambitious and costly of the mass-transit projects (Hopewell) arose, not from government policymakers, but from a private development firm that is raising capital primarily from overseas investors and plans to recoup its investment on real estate development around the stations of the combined rail-expressway project.¹⁷ Given this type of policy development, it is clear that policies may represent a diversity of interests — other than the societal good — may seldom be "rational", and are not likely to originate from a commonly held set of assumptions.

This section of the research would parallel the interviews with Thai government bureaucrats and transport elite. An open-ended or semi-structured interview methodology would be employed to examine the role of international institutions, such as the World Bank and the Asian Development Bank, which play a major role in financing public sector transportation projects; private-sector firms that act as project developers and concessionaires for transport projects; private financial institutions which provide credit to either the government or to private contractors; and non-governmental organizations that have recently begun to put pressure on the government to modify the mass-transit projects.¹⁸

5.3.4 Transit Authorities in Other Countries

While we feel that solutions to Bangkok's transportation problems must be generated from within the country, we also believe that a study of foreign transit organizations, if performed in a descriptive rather than a

normative fashion, could prove useful to Thai policymakers.

In the case of the U.S., there has been nearly two decades of experience with transit authorities empowered to make transportation planning decisions for urban metropolitan areas. These authorities resulted from the transfer of responsibility for urban transportation from private firms to local governments that occurred during the late 1950s and throughout the 1960s. (Hughes 1994) The development of political arrangements to manage transport decisions has been widely analyzed in the U.S. (Hamilton 1981, Orski 1988, Adler and Edner 1990, Hughes 1994) and Europe (Simpson 1988), and the results of these institutional studies should be made available to Thai policymakers.

6 Conclusions

Transportation planning efforts in developing countries have focused primarily on meeting demand for private vehicles and on dealing with the resulting problems of urban congestion. Dimitriou (1992) showed in a methodical fashion how this focus has resulted from the transplanting of Western consultants to carry out transportation planning in the developing world. In this paper, we have argued that the technical solutions to Bangkok's traffic problems have been well documented in the plethora of transportation plans and reports that have been prepared by foreign consultants.

Unfortunately, while international consulting firms have generated stacks of reports detailing the technical solutions to the traffic problem, few have taken the time to carefully study the institutional barriers to implementing those solutions and to work closely with Thai bureaucrats and politicians to understand and overcome those barriers.

This paper proposes a research project that would include interviews with key policymakers in the agencies responsible for developing and implementing Thai transportation policy. Additional elements of the proposed research project would involve analysis of the gap between stated government policy and actual implementation, as well as study of the role played by external organizations in the development of government transportation policy.

By asking a different, non-technical set of questions about Bangkok's traffic planning and management, the proposed research could identify the roots of the institutional barriers to developing a more effective transportation policy for Bangkok. We hope that the fruits of this research will prove useful to policymakers and that their wide dissemination may provoke serious discussion and institutional reform. Another desired outcome would be the development of a truly collaborative effort — involving government agencies, the private sector, and non-governmental organizations — to address Bangkok's pressing transportation issues.

Notes

- 1 Peter du Pont is an energy policy analyst with the International Institute for Energy Conservation (IIEC) in Washington, D.C. and a Ph.D. Candidate in Energy and Environmental Policy at the University of Delaware. Kristina Egan is a project manager in IIEC's Asia Regional Office in Bangkok.
- 2 According to 1993 population data from the Institute of Population Studies at Chulalongkorn University, the Bangkok metropolis had a population of 5.6 million. Based on 1990 population data from the United Nations, Nakhon Ratchasima had a population of 278,000. More recent population data for secondary Thai cities were not available.
- 3 More recent newspaper articles state that the increase in cars is even higher — in the range of 1,000 to 1,200 new automobiles per day. (Phatarawadee 1994)
- 4 Poboorn dismisses the importance of increased road provision as a myth: "Bangkok's level of road provision is believed to be the main cause of its traffic disaster. As a result, a major and common focus in solving the traffic problem is to build more roads. But data from cities around the world demonstrate that the proportion of land devoted to road space is not unusually low (e.g., Paris, Hong Kong, and Munich are almost identical to Bangkok in this factor). Many Asian cities have a low length of road per person similar to Bangkok, while some cities such as Surabaya, Hong Kong, Manila, and Jakarta have a lower road length per capita than Bangkok."
- 5 The Din Daeng Intersection, near the Mass Communication Organization of Thailand.
- 6 After several years of delay, the Bangkok Metropolitan Administration in late 1996 announced plans to begin operating an automatic traffic light control system at 143 intersections. The cost of installing this initial part of a larger computerized traffic control system was US\$9 million. However, there apparently remains significant skepticism among police and city officials as to the effectiveness of the system, and the contract to expand the system to cover an additional 226 intersections has been suspended.

(Assavanonda 1996)

- 7 Recent newspaper articles have noted that prices are increasing noticeably due to the traffic congestion: "Traffic-related problems in Bangkok have taken a toll on people's living expenses country-wide as business proprietors have increased their product prices to cover the rising cost of transport in and out of the capital due to traffic congestion. (*Bangkok Post* 4 Nov. 1994:3)
- 8 The U.S. fuel economy standard for automobiles is 8.55 liters per 100 km.
- 9 This assumes an average vehicle length of 5 meters.
- 10 Curitiba, Brazil is a well-known example of a city that has developed an integrated and effective public transportation system. Although Curitiba has a level of car ownership similar to other like-sized Brazilian cities, the rate of car use is much lower (due to the quality of public transportation). A major factor in this success has been the leadership provided by Curitiba's long-time mayor, Jaime Lerner. Another factor has been the central planning role of the Research and Urban Planning Institute of Curitiba, which coordinated transportation planning decisions in that city since the early 1970s. (Birk and Zengras 1993)
- 11 The term "tax holiday" means that the company is given a waiver from paying corporate income taxes for a specified number of years.
- 12 There are several examples of overlap and implementation difficulties due to the fact that the megaprojects have been planned largely by the private sector rather than by the centralized government authority. The Megaproject Management Office in the Office of Land Traffic Management commissioned a study of the areas of overlap between the megaprojects. In February 1994, it was announced that the number of points of overlap or "route clash" had been reduced from 31 to 4. (*Bangkok Post* 21 February 1994) Another case of overlap is a legal wrangle between the Hopewell Co. and the developers of the Don Muang Tollway, a project that predates the Hopewell project. The Thai government ruled that Hopewell will have to change part of its planned route, which runs parallel and adjacent to the tollway for 11 km, so that the developers of the tollway do not have substantial lost revenues. (*Bangkok Post* 1 October 1994) In September 1994, in an effort to reduce the environmental impact of having three elevated transit systems running through the heart of the city, the Thai Cabinet decreed — based on the recommendations of a newly developed Bangkok Mass Transit Master Plan — that the 3 rail systems would have to go underground in a 25 km² area of the city center. After protests from the private-sector transit developers, who argued that the contracts to construct the systems were already signed and could not be changed, the decree was relaxed in July and only applies to future projects (for which a contract is not yet signed).
- 13 For example, the Expressway and Rapid Transit Authority, a government agency, plans to take over the Din Daeng-Don Muang elevated tollway, which has been operated until now by a private company. The government has refused to honor its contract with the firm to demolish two flyovers, and the firm is under financial duress. Since fewer vehicles than expected are using the road, the firm is only recovering two-thirds of its daily costs. (*Bangkok Post*, 2 March 1996. "ETA Steps Up Effort to Control Elevated Tollway.")
- 14 The group's key recommendations were: a ban on private cars on certain streets during rush hours; an increase in license fees and related vehicle taxes, which would be used to fund mass-transit projects; and a much greater focus on mass-transit over road projects. It was ironic that almost all members of the group chose not to ride specially available microbuses (small passenger buses with more comfortable seating than regular buses) to the group's meetings and drove their own private vehicles instead.
- 15 Elmore (1978) describes this interaction using the *conflict and bargaining model*. Essentially this model calls for an understanding of the various incentives (primarily economic) acting on decision-makers. The conflict and bargaining model is similar to what Dye (1992) calls "public choice theory" and Ellerman (1990) calls "social choice theory".
- 16 Ellerman (1990) used such a set of "elite" interviews with transit managers at municipal transit agencies in the U.S. to validate his decision-making incentive model for U.S. transportation planning.
- 17 The financial returns on the Hopewell mass-transit project have been the subject of much speculation. A consultant's report prepared in April 1994 claimed that the internal rate of return on the project would be just 3%, without taking into account the fact that likely construction costs for the project were twice as high as projected by Hopewell. (*Bangkok Post*, 29 April 1994)
- 18 The Traffic Crisis 94 group, which provided a comprehensive set of recommendations to the government, was mentioned earlier. Another coalition of non-governmental organizations waged a public relations and media campaign which led the Thai Cabinet to mandate that sections of all future mass-transit projects be constructed underground in a 25-square-kilometer area in the city center.

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Heading for a New Transport Policy in Sweden

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Key words

Infrastructure investment, CO₂ targets, transport policy re-evaluation

Abstract

Swedish policy makers see a need for a thorough re-evaluation of transport policy and its related governmental structures. The focus of investment will be shifted away from major infrastructure construction to more modest measures such as improvements of existing routes. An important element will be improving road safety. Reduction of noxious emissions, especially greenhouse gases is seen as vitally important.

Introduction

REDUCED investments in highways by 50 %, but increased inputs of 30 % for maintenance and operation of the national road network. Increased funds for safety and environmental measures. Heavy investments to increase the carrying capacity of railway lines in order to make the railway system more competitive. These are some of the proposals in an interim report by a parliamentary commission in Sweden – *Heading for a New Transport Policy*, Government Commission on Transport and Communications, 1996 (SOU 1996:26).

To meet the carbon dioxide target the commission suggests heavier carbon dioxide taxation, regulation of the specific fuel consumption of vehicles and a rapid introduction of bio-based fuels. The commission also proposes experiments in four counties for testing a planning process which strengthens political control of infrastructure planning.

Infrastructure planning is inseparable from traffic policy

The commission has been given the task of drawing up a national plan for communications in Sweden which will form the basis of a new resolution on transport policy to be passed by the Government and Parliament in the spring of 1998. That plan will be presented by the commission in the final report in March 1997.

Sweden makes ten-year-plans for investments in transport infrastructure, plans which are revised every fourth year. We have an integrated planning of highways, railways and county traffic facilities. The first step is to make a strategic plan for infrastructure. This strategic plan should point out:

- financial resources for road and rail infrastructure;
- financial resources for construction, maintenance, operation and special measures for traffic safety and good environment;
- goals for measures in infrastructures.

When the Government and Parliament have come to a decision about the strategic plan, the Swedish Road Administration, Swedish Rail Administration and the County Administration Boards are given the task to draw up concrete plans for investments and maintenance during the planning period.

The commission should supervise the planning process for the plan 1998–2007. In order to fulfill this task we have studied alternative approaches for the development of infrastructure during the period 1998–2007. The commission also recommend one approach in the interim report.

Maybe it looks strange to first decide a strategy for development of infrastructure and after that form a new overarching transport policy. Infrastructure investments cannot be viewed in isolation from society and transport policy. Both the necessity and the focus of investments are heavily dependent on the objectives defined by society for transport policy. Equally crucial are the decisions made concerning economic instruments, the structure of cost liability, regulations on vehicles and fuels or State procurement of traffic in various forms.

The sequence is however given by our terms of reference. The Government has a strong desire to finish the work with new infrastructure plans and a new transport policy before the next election in Sweden. But next time the infrastructure plans will be revised we will have a new overarching transport policy as a base for the work.

In drawing up our proposals on the focus of infrastructure planning we have made a general analysis of various other measures needed in order for the objectives to be met. A more concerted and cogent analysis of the transport policy and infrastructural measures needed in order to achieve the objectives will be presented in our final report. Several of the measures to be considered are of such a kind that they may come to affect the sum total of traffic inputs and the balance between different types of transport.

Thus our standpoints on general issues of transport policy may have an impact on the planning of infrastructure investments.

Analyses of alternative focuses

We have analysed five alternative focuses for the development and maintenance of infrastructure:

- A **basic alternative** including all measures which are judged to be socio-economically profitable.
- An alternative attaching special importance to the objective of a **good environment**.
- An alternative attaching special importance to the objective of improved **traffic safety**.
- An alternative focusing particularly on the attainment of **regional balance**.
- An alternative attaching special importance to **business enterprise issues**.

These alternatives are compared with a *comparative alternative* (zero alternative) which only includes measures which are expected to be completed or begun by the New Year 1998.

In the light of the analyses of the alternative focuses, we have drawn up a *draft focus for infrastructure planning for the period 1998-2007*.

Heading for a new direction of infrastructure development

Our proposals imply a redirection of infrastructure planning.

- Following a period of heavy expansion of the national trunk road network, operational and maintenance-related inputs will have to be increased. We propose an increase of rather more than 30 per cent for operation and maintenance of

the entire national road network, compared with the present-day level (1995).

- For the rail network we propose that the allocation for operation and maintenance be raised by 22 per cent compared with the present-day level.
- Heavy investments are recommended to increase the carrying capacity of railway lines and of the regional road network.
- Of rail and road investments totalling MSEK 58,000 it is proposed that 60 per cent go on railways and 40 per cent on roads.
- Investments in the enlargement of national highways are reduced by more than half compared with the existing plan. This is partly because the standard of the road network has been elevated through enlargements in recent years and because we have now given priority to operation and maintenance within a limited budgeting frame. It is also connected with a new view of development strategy. We endorse the systematic approach and the development of a functionally integrated road network which have characterised planning, but we no longer attach any intrinsic importance to a uniform geometrical and traffic-technical standard. Every part of the national routes should be enlarged at the rate and given the standards which are justified by its own traffic conditions. The parts we have studied are relatively large and naturally demarcated. There is no question of replacing investments in new trunk roads with spot measures, but the big national trunk roads can be divided up into sections with differing traffic conditions.
- Traffic safety work, for socio-economic reasons, will concentrate on implementing measures under the national traffic safety programme. Measures relating to the road system will be concentrated on spot measures for black-spot intersections and sections instead of larger road investments.
- Our proposals imply a heavy reallocation from large road investments to the operation and maintenance of the road network. Since the poorest road standard is to be found on the minor road network in the forest counties, the increased operating and maintenance allocations

and load capacity investments we recommend imply an equalisation of regional imbalances in road standards. We also recommend special measures for the further encouragement to regional development and business competitive capacity.

We propose a planning frame of MSEK 190,000 for investments and road and rail operation and maintenance during the planning period 1998–2007. This fits in well with the investment cut in this field resolved on by the Parliament for the coming budget period.

Other measures are necessary to meet the environmental targets. Infrastructure planning must agree with policy objectives for transport and the environment. The actions proposed must, for example, as far as possible be environmentally appropriate and conducive to traffic safety.

Infrastructure measures, however, are of limited significance in the solution of environmental problems. The purpose of infrastructure is to provide good opportunities for the transportation of people and goods. The achievement of environmental objectives demands further measures over and above those affecting infrastructure.

Our analyses have shown that, of the environmental targets we have defined, the carbon dioxide target is the most difficult to achieve. As an intermediate target, we have assumed that carbon dioxide emissions in the road sector will decline by 20 per cent between 1990 and 2020.

Measures of several different kinds are needed in order to achieve the carbon dioxide targets. We have assumed heavier carbon dioxide taxation, regulation of the specific fuel consumption of vehicles and the rapid introduction of bio-based fuels.

Increased carbon dioxide tax

In our calculations we have assumed that carbon dioxide tax will be raised in such a way that the price of petrol, in real terms, will rise by 10 öre (SEK 0.1) per litre each year between 1990 and 2020. The real price rise for the period ending 2020 will then be SEK 2.30 per litre of petrol. A corresponding increase is assumed in the price of diesel fuel.

A large part of the scope created by this taxation revenue ought, in our opinion, to be applied to State support for environmental measures in the transport sector. Some form of compensation will probably also be needed for persons travelling long distances to work. If the rise in fuel prices should prove to have unacceptable distributive effects to the detriment of rural areas, those effects should be offset by means of regional policy measures in the broad sense.

We will be analysing the question of carbon dioxide tax and related supportive measures in closer detail in our final report.

Regulation of vehicle fuel consumption

In order for carbon dioxide emissions from car traffic to be substantially reduced, cars will have to be made more fuel-efficient. There are several conceivable ways of inducing improvements in the fuel economics of new cars, e.g. regulations or differentiated taxes. It is difficult, however, for Sweden to introduce such instruments on its own. International agreements are needed.

In a specimen calculation we have shown how fuel efficiency will have to be improved in order for our carbon dioxide target to be attainable. We assume that the specific fuel consumption of new cars will gradually decline until 2005. As from that year, new cars are on average to have a fuel consumption of not more than 6.3l/100km (the average fuel consumption of new cars today is 9.2). Technically this is quite feasible, but it will make heavy demands on international co-operation.

Support for the introduction of bio-based fuels

In our calculations we have assumed that from 2010 onwards, bio-based fuels will on average provide 15 per cent of the energy content of fuel. This can be achieved through a combination of measures, including both the development of vehicles running on bio-based fuels only, e.g. ethanol or methanol, and low admixture of bio-based fuel to the fossil fuel.

In order for this to be possible, both technical development and some form of public support for the introduction of bio-based fuels will probably be needed. We intend to return with proposals on this subject in our final report.

It is also necessary for Sweden to make active efforts to secure amendments to the EU directive on excise duties on mineral oils, so as to facilitate the introduction of bio-based fuels.

Small effect on road traffic flows, but larger on emissions

Infrastructure measures in the national road network outside urban communities have only a marginal bearing on traffic generation and choice of transport. Our proposals, therefore, will have hardly any effect at all on the development of road traffic. The presumed increase in carbon dioxide tax and regulation of fuel consumption will between them make motoring cheaper in real terms per kilometre. Traffic growth between 1993 and 2010 is estimated at roughly 30 per cent.

As a result of heavy investments in railways, passenger rail traffic is expected to increase by about 80 per cent during the same period. But the car is still very dominant.

Therefore the focus of infrastructure planning makes little difference to emissions of air pollution and carbon dioxide.

The possibility of achieving the carbon dioxide target with a 20 per cent reduction between 1990 and 2020 will depend entirely on the possibility of reducing specific fuel consumption in motor vehicles and increasing the proportion of bio-based fuels to the extent which we have assumed.

Stricter exhaust rules are needed in order to achieve the aim of an 82 per cent reduction in nitrogen oxide emissions between 1980 and 2020. Failing this, the reduction is expected to be about 65 per cent. The aim of reducing emissions of volatile hydrocarbons will be achieved in the short term, but in the longer term the growth of traffic will necessitate stricter exhaust regulations.

Targeted measures in the form of noise protection will remedy the noise problems of the 25,000 persons living alongside national highways and exposed to noise levels exceeding 65 dBA. The long-term target of 55 dBA will not be achieved, however, and serious noise problems will persist on the municipal road network.

Improved traffic safety

By the end of the planning period (2007), the number of persons killed in road traffic is expected to have fallen to about 370, as

against 589 in 1994. The number seriously injured is expected to decline from 4,221 in 1994 to about 3,600 in 2007.

Our analyses show that only a small part of the improved traffic safety can be accounted for by heavy road investments. The most efficient measures are spot measures for black-spot intersections and sections together with all "soft" measures in the national traffic safety program. This program includes reduced speed limits, control of the drivers, safer cars, increased use of safety equipment etc. In the long run the commission want to go for a zero-solution. No deaths or seriously wounded will be accepted in road traffic.

Equalisation of regional imbalances

The investments in operations and maintenance have a strong regional profile. Nearly half the increase will be in northern Sweden. Roughly 20 per cent of all frost-damaged roads can be remedied (4,000 km out of 19,000).

The investments in operation and maintenance and in load capacity improvements will mean a great deal to business enterprise, since they will improve the scope for heavy goods transport both by road and by rail. Special investments totalling MSEK 5,350 are recommended for rail freight traffic.

Experiment in stronger political control

We recommend experiments in Skåne whereby responsibility for drawing up and finalising plans for county traffic facilities (LTA) for the period 1998–2007 is transferred from the County Administration Board to the Skåne Administration.

We also recommend that the Stockholm County Council be made responsible for LTA planning in the County of Stockholm (instead of the County Administration Board).

Both in Skåne and in the County of Stockholm, the planning process will be constructed in such a way as to strengthen political control and improve co-ordination between different types of transport systems, between transport and infrastructure and between infrastructure and other physical planning.

In the Stockholm County experiment, special importance will be attached to developing and testing a planning process in which

urban planning and infrastructure planning are integrated with the planning of mass transit, goods transport and motor traffic. There should be good opportunities for this type of integration in the County of Stockholm, where the County Council is responsible both for regional planning and for public transport.

The experimental activities in Skåne and the County of Stockholm must be co-ordinated with the Government's response to the proposals of the Regional Government Commission and with the experimentation which those proposals may lead to. A Government Bill is expected in September 1996.

In the Counties of Västernorrland and Jämtland we propose experiments aimed at strengthening regional influence on the maintenance of county roads. Certain measures at present classed as maintenance and funded out of the operations and maintenance allocation of the National Road Administration or the special load capacity plan, e.g. frost-proofing and road capacity reinforcement, are instead to be regarded as investments and transferred to the LTA allocations. The corresponding money is also to be transferred to the LTA allocations. In this way the counties will have more to say concerning which measures are to be taken and in what order.

Evaluation of transport policy

Our terms of reference require us to analyse whether the transport policy aims in the resolutions passed by the Parliament in 1988 and later have been achieved. The following are some of the important conclusions resulting from the transport policy evaluation conducted on our behalf.

- **Input data need to be improved** - In our view, the input data for investment planning must be improved and clearer guidelines are needed concerning the input data required for different planning situations.

- **Decisions must be followed up** - In our view, clear rules and distinct responsibility are needed for follow-up at both national and regional levels. The results of infrastructure investments should be followed up in relation to the targets defined for transport policy and for individual projects. It is important to make clear whether costs and effects agree with those indicated in the input data.

- **Financial responsibility must be reviewed**

- The principles of financial responsibility need to be reviewed and ways of improving calculations of the marginal socio-economic costs analysed, because at present these calculations are surrounded by a great deal of uncertainty.

- **The balance between public planning and free competition in different types of transport systems should be analysed**

- The evaluations show that the deregulations of air traffic and taxi services have had both positive and negative effects, although it is too early yet to pronounce on the long-term outcome. The deregulations appear to have favoured densely populated areas but to have had a number of negative effects on regions with lower traffic densities.

It is essential to analyse whether measures are needed to compensate rural areas for the effects of deregulation, and to study what may be an appropriate balance between public planning and free competition.

Our continuing work

As our work continues, we will be addressing all the problem fields observed in the course of the evaluation. We will be studying the principles and general issues of transport policy concerning the way in which the transport system is to be organised, controlled and financed.

In our overarching transport policy analyses of the structure of financial responsibility, the state of competition between different types of transport systems, State procurement of regionally necessary transport etc., air transport and shipping will figure much more prominently than they have done in our interim report, the main concern of which has been investment planning.

We will present our final report in March 1997. In October 1996 we will present a second interim report with proposals for road traffic taxation.

The Swedish Governmental Commission on Transport and Communications is a parliamentary commission. All political parties in the Parliament are represented in the commission. Rolf Annerberg, Director General of the Swedish Environmental Protection Board is the Chairman.

The Future of Air Travel and International Tourism

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Introduction

FEW areas of public policy and practice better illustrate the difficulty of reconciling the growth of the economy with protection of planetary health than the one relating to the air travel and tourism industries. We are having to learn fast that the capacity of the environment to allow abuse of its self-regulating mechanisms - which have evolved over probably hundreds of thousands if not millions of years - is not limitless. There is an urgency to review current policy and practice on this subject for it has perhaps the greatest and longest-term significance for our future well-being than any other on which politicians should be adjudicating. Given the broad scientific consensus that climate change is underway and that human activities are almost certainly contributing, decisions affecting the future of the two industries must not be taken without due consideration to the destabilising effects on the planetary environment of adding pollution to the upper atmosphere and thereby adding to global warming and ozone depletion.

Trends

Worldwide energy demand is growing, apparently inexorably. The BP 1996 Statistical Review of World Energy shows that, in the last 20 years, consumption of fossil fuels - coal, gas and oil - has risen by well over a third. Crucial interacting which have brought this about are rising material standards and the growth of the world's population. As for the future, the UN Population Fund forecasts an increase from the current 5.7 billion persons to 8.3 billion by 2025, 90 per cent of it in poorer countries.

At the same time, economies in the developed world and in many parts of the developing world, whose populations clearly have a greater claim on increasing their consumption of fossil fuels - the World Energy Council has pointed out that two billion people in them have neither electricity nor other communal sources of energy - continue to grow apace. Both growth of the economy and of population are set to have an even greater impact in the future on

this consumption unless progressively difficult policy changes are made: per capita carbon dioxide emissions from the use of fossil fuels in the US are roughly double those in the UK, they are ten times those in China and nearly 30 times those in India. Contemplation of the consequences of the populations of the developing world enjoying western lifestyles in the next century should help to focus the mind wondrously!

International professional, business and sports events are becoming more frequent, drawing on participants and spectators from further and further afield. Talk to senior businessmen and they are likely to make reference to the number of times they 'have' to fly, or to boast of distant destinations they have visited frequently. Holidays are advertised in newspapers offering at phenomenally low prices the chance to experience for a week or two the culture and climate of ever more exotic locations, invariably by flying, and many billed euphemistically as 'eco-tourism' - a night in Lapland to see the midnight sun; a journey of discovery to north-west China along the Silk Road; Livingstone's Africa - with the magnificent view of the Victoria Falls or a local flight over a gathering of 500 zebras; Madagascar - a must for anyone in love with nature; passage to the wonders of the antiquities in the Middle East; the highlight of the Argentinian tour, Die Walkurie in Buenos Aires; Bermuda for weekend breaks - eight remarkable golf courses; a five-day tour of Australia - feed the dolphins in the wild; island hopping 'down under'; a 15-day cruise up the Irrawaddy to Mandalay; 'spiritual awakening' by flying to Tuxtla in Mexico; a six-night sand safari in Dubai; Hong Kong where it is worth a taxi ride to market for 'name' clothes manufactured locally for world markets, and take public transport to the Temple where registered fortune tellers will read your palm; go bungee jumping in New Zealand.

International air travel is increasing at a much faster rate than most other fossil fuel-consuming sectors of the economy. Look at recent statistics on the number of people flying, distances travelled, and the quantity

of aviation fuel used worldwide. In the last ten years alone, international UK and foreign aircraft movements using airports in this country have increased by 65 per cent and passengers by 89 per cent; air cargo tonnage has risen by 94 per cent and cargo and mail tonne kilometres flown by 88 per cent.

Flights to and from Member States of the EU have increased by 87 per cent and to the rest of the world by 95 per cent. The expectation is that this proportion will rise sharply in the future. Air travel now accounts for about one-sixth of fuel used for transport purposes, with a major contribution from the half a million UK residents now travelling to North America each year. This might be thought of as a remarkable figure - but it represents less than one per cent of the population. In the same ten years, the number of international and domestic passenger kilometres flown on scheduled airlines has almost doubled. World airlines now carry over 1.25 billion passengers, with a predicted increase of about five per cent per annum up to the year 2010 and probably beyond.

Links with global pollution

Whilst attention is now paid to the environmental impacts of airport location and aircraft movements, the focus tends to be on those exclusively local to airports. However, interest is now being shown in the effects of exhaust emissions on the stability of the troposphere and stratosphere. Pollution from aircraft is now regarded as more significant owing to a better understanding of what happens when the emissions are released at cruising altitudes. Subsonic aircraft flying at levels within the upper troposphere and lower stratosphere, which is extremely sensitive to chemical change, has been the subject of major studies, notably those that have been undertaken by NASA in the US in the last few years.

The two primary concerns are the thinning of the ozone layer which protects the earth from harmful ultra-violet radiation; and carbon dioxide emissions contributing to global warming, with water vapour promoting the formation of clouds, and carbon monoxide and hydrocarbons adding to the problem. As oxides of nitrogen decrease ozone in the stratosphere, there must be considerable doubt about the prospects for a new generation of supersonic aircraft under consideration by Japanese and American manufacturers as these aircraft have to fly at

this higher level. Paradoxically, lower down, in the troposphere where most commercial jets fly, the release of these emissions increases ozone. The damage is compounded by the fact that more fuel is needed at lower altitudes and pollutants remain there much longer.

At present, air traffic is responsible for 15 to 20 per cent of the global warming effect of fossil fuel used for transport purposes. As noted in the Royal Commission on Environmental Pollution Report, an annual rate of increase of two to three per cent in this is predicted by the year 2010. However, owing to the disproportionate effect of the emissions at high altitude, it has been calculated that 50 per cent of this contribution will stem from aircraft, a figure justifying even greater concern as carbon dioxide emissions have a longevity of 50 to 200 years.

Climate effects

Evidence is accumulating of the effects of the growing use of fossil fuels increasing concentrations of greenhouse gas emissions. The rate of temperature change is now greater than at any time during the last 10,000 years: nine of the ten warmest years of the last 140 years of world-wide temperature readings have occurred since 1980. It has been calculated that, of the extra 320 billion tonnes of carbon emitted into the atmosphere during the last century and a half, about 60 per cent has been absorbed by warming the oceans and by forest 'fixing', leaving 40 per cent in the atmosphere to increase air temperatures. Rises of 3.0 degrees Centigrade above the average for the last 30 years have been recorded in parts of Siberia where methane and other organic gases are now known to lie at much shallower depths than was previously thought, and the release of which could accelerate global warming as permafrost thaws over the coming decades. Scientists at the Meteorological Office's Hadley Centre for Climate Prediction and Research have forecast an increase of 2.0 degrees Centigrade in world temperatures by 2050 unless urgent action is taken.

Temperature changes are also thought to account for the higher incidence of extreme climatological events - floods, droughts, shrinking glaciers, storms and hurricanes. The sea level rises of 25 cms. in the last 100 years are explained by the expansion of the warmer oceans, and further average rises of

15 to 95 cms are predicted. Compared with the previous decade, sea ice melting in the Arctic has doubled in the past decade. The ice shelf in the Antarctic is retreating at an unprecedented rate, with a temperature rise recorded of 2.5 degrees Centigrade in the last 50 years. The ozone layer is thinning over both poles, including a 60 per cent decrease in its concentration over the Antarctic.

It was in recognition of the possibility of irreversible damage from the rising concentrations of greenhouse gases, at least partly attributable to human activity, that the Intergovernmental Panel on Climate Change (IPCC) was set up nearly ten years ago. In 1990, it produced a report stating that atmospheric concentrations of carbon dioxide at levels posing no danger to the stability of the world's climate requires a 60 to 80 per cent reduction. In the light of further research by the hundreds of scientists contributing to the Panel's work, it has not seen the need to revise its consensual judgement. Its latest report indicates that, even if emissions were held at their current level, concentrations would still rise by about 40 per cent over the next hundred years. One of its working groups recently calculated that the capacity of the oceans to act as carbon sinks is lower than had been previously thought.

Grounds for allaying fears and special pleading

In light of all the evidence and commentary set out above, it could have been expected that there would be intense debate about the prospects for air travel in the future, particularly from the viewpoint of the related industries' contribution to economic growth and employment. Clearly, public policy in this domain should not be determined in isolation from considering its ecological implications. What have been the responses of those vested with responsibility for reaching rational decisions in areas such as this where public interest objectives can conflict so starkly? Five key arguments in favour of limiting interference with the growth of the aviation and tourist industries can be identified.

Scientific uncertainty

It is claimed that there are both positive and negative feedbacks affecting global warming and ozone depletion from aircraft flying at high altitudes, and that the effects of reductions in urban smog and acid rain-

reducing aerosols, which increase exposure to global warming, are not yet properly understood. It has been suggested too that many years must elapse to allow for precise figures to be made for research and analysis in order to measure the chemical and physical characteristics of the atmosphere, particularly bearing in mind the fact that, for instance, the occasional volcanic eruption is responsible for more damage to the ozone layer than can be identified as attributable to human activity. Thus, it may be too early to say that the earth is necessarily in the grip of global warming triggered by human activity: in other words, most climate scientists may have made incorrect calculations. The wisdom of a 'no regrets' policy has therefore been proposed in which reliance at this stage is placed on technology to deliver what is seen to be cost-effective at present. Such a policy was supported by signatories to the UN Framework Convention on Climate Change at Rio in 1992 who agreed that 'lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to deal with climate change'. In addition, the transfer of shorter 'long' journeys to more fuel-efficient rail travel has been encouraged where this can be an available alternative.

However, in its 1994 report, the Royal Commission on Environmental Pollution noted that 'even if global emissions were stabilised at 1990 levels, atmospheric concentrations of carbon dioxide would continue to increase for several centuries'. Not surprisingly, the governments of countries with substantial populations living in river delta regions, such as China, Bangladesh and Egypt, and the representatives of the alliance of the 35 small low-lying countries, have argued that they cannot afford the luxury of waiting for conclusive proof.

The roles of operational economies and technology

The second line of defence has been to cite the contribution that technology is making to reducing fuel consumption and pollutants by improving efficiency in various operational aspects - increased seat occupancy rates through fares concessions, new combustion techniques, cleaner engines and better aerodynamic performance, and newer wide-bodied aircraft carrying more passengers. It is now claimed that fuel consumption can be lowered by 10 to 20 per cent and nitrogen

oxides by 50 per cent in the next 20 years.

However, it is clear that these measures achieve a reduction in the unit cost of travel so that when combined with more competition, the rate of growth in air travel expands well beyond the savings that have been and still can be brought about by these means. The prospect has been raised that a solution may lie through the development of cleaner emissions from aircraft has been raised by research on hydrogen as a fuel since this would not only minimise the use of finite energy resources but also the consequent release of carbon dioxide. But, use of this fuel produces nitrogen oxides and water vapour both of which contribute to global warming.

External costs

Somewhat more radically, it has been argued that the solution can be found in policy based on fairer and eco-oriented taxation. For instance, it has been proposed that air travel is managed on a 'level playing field' by removing aviation fuel from tax exemption. However, modelling the effect of the higher fares that would come in the wake of this small additional tax suggests that demand would only be marginally affected.

A complementary approach put forward has been to oblige aircraft operators to pay the full 'external' costs of air travel as this would lead to higher fares and thereby also to reduced demand. In this instance, on the other hand, a daunting task would be presented to transport economists who would have to determine notional values for the costs of damage from greenhouse gas emissions and from the thinning of the ozone layer (although this has been attempted). Account too would have to be taken of the effects of these types of environmental damage on future generations, especially if the values were to reflect the fact that the emissions accumulate over time and some have long lives in the atmosphere.

Action at the international level

The next positional gambit has been to point out how unrealistic it would be for any one country to act unilaterally on this issue. In 1992, at a London conference on the world environment, John Major cited the fact that the UK only contributes three per cent of all emissions from human activity and that therefore any decisions taken by his government would make little difference to solving the global problem. On these

grounds, the focus must be on achieving political collaboration on environmental issues at the international level: the success of action on limiting the damage to the ozone layer from the use of CFCs is often highlighted as indicative of this assured, effective, and apparently successful strategy. However, even the effectiveness of the Montreal Protocol on removing ozone depleting gases used in industry must be called into question given recent evidence that more of the depletion of the ozone layer is attributable to other sources than it is to CFCs, and that there is reason to believe that a major one of these is the nitrous oxide emissions from jet aircraft flying in the stratosphere.

Moreover, the wide-ranging issues surrounding the burning of fossil fuels point to the application of this path of diplomacy, in which politicians and scientists work collaboratively, being fraught with infinitely greater difficulties than those relating to the limited number of gases thought to be responsible for the thinning of the ozone layer, and with only a limited number of applications in industry. The inadequacy of the current approach to resolving the problem of greenhouse gas emissions is apparent from the difficulties in even setting what was clearly a wholly inadequate target of stabilising carbon dioxide emissions at their 1990 levels by the year 2000 - a 0 per cent change - as a response to the IPCC call referred to earlier for a 60 to 80 per cent reduction in emissions. The fact that many EU countries are almost certain to fail to meet this modest target suggests that policy in this domain will require more intense activity, particularly if the further target of a five to ten per cent reduction by the developed world by the year 2010 is to be achieved.

Fuel dependency and the partisan claim of the aviation and tourism industries

As a consequence of the phenomenal take-up of air travel, the economies of the destination countries become increasingly dependent for foreign earnings on its growth. With tourism as the third largest industry in the world, with an annual turnover greater than US\$3000 billion, governments understandably become anxious if there is any downturn in demand for any reason or if there is any debate about its downside, such as the damage to landscapes, the destabilising of local cultures, the pollution

of air and water, let alone questioning or even considering whether the benefits justify the wider ecological impacts. As natural allies in this venture, the industries of aviation and tourism dependent on air travel present a confident stance in spite of the steadily accumulating evidence of climate change, to which they are contributing: their success in promoting and catering for substantial growth in public demand for their services encourages wider participation in the apparently inexorable trajectory of expansion.

The point is made therefore that, in contrast to many other fossil fuel-dependent human activities, no alternative to kerosene exists as a fuel for aircraft, nor is there any prospect of one being found soon enough to allow for conversion to its use. It is claimed therefore that it is more cost-effective to devote attention to achieving reductions in the other sectors of the fossil fuel-using economy than to burden the aviation industry with a requirement to deliver its fair share. It is argued that tourism, which is a growth industry in nearly every country in the world and a substantial and largely irreplaceable source of foreign earnings for many of them, is heavily dependent on air travel as it caters for over 70 per cent of tourist arrivals in at least 20 of the major tourist-receiving countries. In the UK, there has been fierce criticism of the government for not reaching early decisions on how its airport capacity can be increased to accommodate the growth. The concern is that travellers will choose to fly to Paris, Frankfurt or Amsterdam unless the passenger carrying capacity of airports can be increased, and that Heathrow, for example, will lose its status as the leading hub for international airlines in Europe unless it can handle an additional 30 million passengers on top of the current 50 million a year.

Even in the face of the possibility of catastrophic environmental damage owing to the fact that the population of the planet cannot conceivably support the developed world's level of energy-intensive lifestyles, these arguments imply that there is an unarguable right for the aviation and tourist industries to continue to follow their growth paths into the future. Consideration of this issue needs to be seen in the context of the very reasonable intention of the governments of developing countries to advance the material prosperity of their people which, for

instance in the case of China, is almost wholly dependent on reserves of highly polluting coal. Yet it is apparent that, unless the developed world makes major policy changes in this area to demonstrate conclusively its intention of modifying its patterns of activity, it does not have the political base from which to argue for agreement at the international level on the substantial cuts called for by the IPCC. Moreover, it does not have the ethical base either. No doubt, for this reason, the World Council of Churches is, with its moral authority, at long last speaking out on it.

Discussion of issues raised

The UK government policy White Paper entitled *This Common Inheritance* referred to the ethical imperative of stewardship and mankind's duty to act prudently and conscientiously so that the planet is handed over to future generations in good order. It also referred to the full integration of environmental considerations into economic policy decisions to achieve sustainable development which it warned was not open to compromise. In practice, this imperative and its political implications may require a dramatic shift from the dedication to greater efficiency and productivity. The objective of rising material prosperity may have to be abandoned in favour of solutions derived from analysis of a sustainable policy base. As yet, however, governments around the world have given no warning that the public may have to be called upon to make necessary changes which are likely to entail substantial rather than modest alterations to the lifestyles that they have only been able to adopt because these implications have been largely ignored.

If climate change, with its potentially catastrophic consequences, is to be avoided, the IPCC target for reduction must be considered in the context of international and intergenerational equity. There are neither moral grounds nor political prospect of obtaining international agreement on any other basis for the populations of the developing world cannot be expected to reduce the impact of their lifestyles by making the same 60 to 80 per cent contribution called for by the IPCC that we do in the affluent West. For this reason, the expansion of air travel and tourism to meet future demand must be considered in the context of its ecological consequences. Given

the ceiling below which human activities which lead to greenhouse gas emissions can be maintained whilst at the same time preventing the destabilisation of the climate, with its attendant major hazards, there would appear to be strong grounds for contemplating the possibility of the need to manage the marked contraction rather than expansion of the two industries.

The gravity of the situation is reflected in the following Tables. On a per capita basis, the UK must cut its emissions by about 90 per cent, that is over a five per cent annual reduction from now to 2040 - a very tall order. But the rate rises to six per cent if we do not start until 2000. Currently, total annual UK emissions of carbon dioxide from man-made activities are over 560 million tonnes, shared out between the various sectors shown in Table 1.

Table 1. UK carbon dioxide emissions in million tonnes, by sector

Transport	139	25%
Domestic	157	28%
Industry	164	29%
Other	107	18%
All	567	100%

Source: Dept of Environment (1994)

Table 2 shows these figures set out in relation to current per capita emissions, together with the lowering of these emissions pro rata within the range of the recommended IPCC global reductions, and the equity one based on its central figure. It can be seen that the average person in the UK accounts for annual emissions of 9.78 tonnes. To illustrate the significance of these figures for the future of air travel, especially for tourism, reference can be made to the quantity of carbon dioxide emitted on a round trip by air from London to Florida, based on the aviation fuel used and typical

Table 2. UK average annual per capita carbon dioxide emissions in tonnes, and reductions needed to stabilise the world climate

	Current	IPCC recommendation		
		central 60% reduction	high 80% reduction	equity-based 90% reduction
Transport	2.42	0.97	0.48	0.24
Domestic	2.71	1.08	0.54	0.27
Industry	2.83	1.13	0.57	0.28
Other	1.84	0.73	0.37	0.18
All	9.78	3.91	1.96	0.98

aircraft seat occupancy on such flights. Carbon dioxide emissions for one person's round trip accounts for 1.8 tonnes, that is, just under half of the total average annual tonnage that can be allowed for each person for all purposes, with the central IPCC recommendation, and nearly double the annual tonnage that could be allowed on an equity base, if the world climate is to be stabilised.

It is clear that every sector of the economy must contribute its share towards reducing its greenhouse gas emissions, and especially those sectors causing most damage. It hardly needs to be said that, if the reduction is not delivered by some sectors - especially by the high energy-consuming populations of the world - then other sectors and populations would have to make even larger reductions to avert catastrophe. The environmental problems posed by air travel will not go away. It is clear that the growth in air travel, particularly if airport capacity is increased and the international tourist market continues to expand, will intensify the environmental problems of climate change and ozone depletion. From this perspective, the current path of aviation and international tourism runs counter to the goal of environmental protection.

Given the obviously higher claims on fossil fuel consumption for the winter heating of buildings, the generation of electricity, the power needed for industry, and the fuel for land-based motorised transport, air travel cannot be excused from measures required to achieve the necessary reductions shown in Table 2. Indeed, in the hierarchy of basic fuel-dependent human activities for the world's population now and in the future, little air travel can realistically be classified as 'essential'.

The Royal Commission on Environmental Pollution indicated that ways must be found, and compromises reached, to reconcile the conflicting objectives of economic growth and environmental protection. What needs to be faced is the very real dilemma that, in view of the planet's limited capacity to absorb greenhouse gas emissions from human activity without destabilising the climate, there is, at the least, a distinct possibility, and more likely a probability, that these objectives cannot be reconciled. The longer that action is put off in the face of this simple but crucial deduction, the more we intensify social and environmental problems for the

future, and the more we create difficulties for the next generation in finding workable solutions.

It is comforting to note that not all voices within the aviation industry are complacent. Four years ago, the Director of the International Civil Aviation Organisation stated that

'For many years, we have been accustomed to growth in the aviation industry. Now we are faced with the prospect that environmental problems could restrain growth. It is conceivable that they might even lead to a reduction of air transport activity... The aviation industry has an obligation to the world's population, and to future generations, to act responsibly on environmental issues, particularly the global ones. How to do this while protecting aviation's own legitimate interests is one of the most serious challenges facing civil aviation today'.

This strong statement mirrors the arguments set out in this article on the dangers of arriving at decisions affecting the future of the aviation and tourist industries which pay insufficient regard to the interface between the objectives of transport and environmental policy.

This critical issue could have been the focus of the House of Commons Select Committee inquiry on *UK Airport Capacity* in its 1995-96 Session. However, when first raised with the Committee Chairman, it was ruled to be outside the Inquiry's terms of reference. However, these terms were widened during its course to allow evidence to be taken on it. The Memorandum written by the author of this article following this decision included the following three recommendations: first, that a methodology should be established to enable emissions from air transport to be included in national inventories so that these can be assigned to individual countries; second, that Government should be working towards setting more realistic targets on greenhouse emissions, including targets for the aviation industry; and third, that this industry should be involved in preparing policies and programmes to deliver its share of the reduction of these emissions in order to achieve the global objective of limiting climate change.

The Report of the Committee, published in the early summer of last year, does in fact refer to studies currently in progress on climate change and on the impact of aircraft emissions at high altitude. In its conclusions,

it states that Government should determine its policy from a national interest perspective and calls on it to publish its response to these studies and its implications for a sustainable level of air transport. In light of this, it proposes that a new policy statement on aviation and airport capacity is produced 'without undue delay (later spelled out as within two years) so as to inform public debate... It may then need to revise its policy that demand should be met where it arises' (my italics), that is a possible trebling of passengers in the next 20 years.

Nevertheless, the wording in the Report gives every impression that it does not consider that the outcome of this process will seriously affect demand: its contents are mainly devoted to looking at alternative means of and locations for accommodating the forecast demand and speeding up 'cumbersome' planning procedures, apparently accepting the concerns expressed that, if this is not done, the UK economy would be seriously damaged. Indeed, the questioning of this witness by the Chairman of the Committee implied strongly that if climate change were to prove on balance to be in the UK's national interest, it should be welcomed! And another member of the Committee in apparent justification of its members' demonstration of occasional tunnel vision stated that their role was to represent their constituents, in turn implying that MPs cannot hold independent views.

A further indication of the failure of Government and relevant institutions to begin to address this subject in a manner reflecting its importance - the likelihood that industrial and commercial practices and current lifestyles will have to be substantially modified - is apparent in the stance taken by another House of Commons Select Committee. In May last year, the National Heritage Committee announced its intention of conducting an Inquiry, the main aim of which was to establish what can be done to encourage tourists to come to the UK. In spite of the obvious error of determining public policy decisions in this domain without reference to the consequential release of greenhouse gas emissions into the upper atmosphere - almost certainly a key issue to consider - its Chairman ruled that evidence on this topic cannot be taken as it would extend the scope of the Inquiry beyond the time available.

Conclusion

It would appear that politicians and public alike are, trance-like, travelling down the road to ecological *Armageddon*, intoning the *mantra* about the economy's dependence on catering for growth and the need for new jobs, whilst uttering pious statements about mankind's duty to act prudently so that the planet can be handed over to future generations in good order.

When Darwin's *Origin of Species* was first published, the ecclesiastical authorities kept their collective heads well down, hoping no doubt that his 'theory' would be disproved and that their image of God as the designer of each species on which their texts were and remain based would triumphantly prevail.

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- Now, we have a new heresy, this time challenging two long-standing and widely-shared beliefs, first, that economic growth has no limits and that the demand it generates from the six billion on the planet is sustainable in a resource sense, and second, that ecological problems that come in its wake can be resolved satisfactorily.
- Clearly, in the policy domains which are the subject of this article, governments around the world, especially those representing its more affluent member states, cannot go on indefinitely side-stepping the need for detailed studies of the crucial interface between policy on promoting air travel, and that sector of tourism dependent on it, and international policy on limiting greenhouse gas emissions.
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