# A Transport Structure Plan

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# Preface

In August 1993 the traffic counselor of the Royal Netherlands Embassy in Washington was approached by the staff director of the World Development Report Office of the World Bank, with the request to make a contribution to a background paper to the World Development Report 1994.

This paper should be based on the "Second Transport Structure Plan—part D: Government Decision" of the Netherlands Government.

As a result of this request, the Directorate General of Transport of the Ministry of Transport, Public Works and Water Management in The Netherlands invited DHV Consultants BV to prepare a draft paper.

This paper, called "A Transport Structure Plan," includes the relation to developing countries with respect to the principles of the long-term transport policy (objectives, strategies, and guidelines). It serves further as an instrument for public debate.

DHV Consultants BV wishes to express its appreciation to the World Bank, the Royal Netherlands Embassy, and the Ministry of Transport, Public Works and Water Management for the positive feedback during the preparation of this initial draft paper.

**Transport Structure Plan: what is it and why have it?**

The central issue the transport sector addresses, now and in the future, is the provision of accessibility.[1] Accessibility is an aspect of the quality of life of an individual or a family; a *need* which the *decision unit* attempts to satisfy in its own best way within its opportunities or possibilities. Accessibility obtains concrete form by the use of means-of-transport for bridging the distances between different places where different human, social, or economic activities are undertaken. Central government has the duty to provide:

- a framework for transport and traffic developments taking into account needs and desires from society at large,
- coherence and consistency in policies on land-use, environment, economy, and transport,
- investments which cannot be provided by the private sector (road-rail-water-infrastructure).

For doing this, it needs:

- to closely monitor developments (in land-use, environment, economy, and transport),
- a long term vision, providing some guarantee (reducing uncertainty) for investors,
- an instrument to provide guidance to lower (local) government (central government sets conditions and enters into arrangements, agreements, and

[1] The ability of people to move themselves and their goods (mobility), taking into account the ability or ease to reach various destinations (accessibility).

contracts with lower government).

A Transport Structure Plan is a document presenting the principles of the long term transport policy: the long term objectives at which the policy aims, the strategies to be followed in order to reach the objectives, and the guidelines for elaborating the (medium-term) transport plans.

At the national or interurban level, the Transportation Structure Plan is substantiated with a set of maps showing anticipated future networks: highways, railways, inland waterways, and sometimes, pipelines and domestic aviation. The maps clarify central governments' long term intentions to (p)reserve continuity in transport corridors, which otherwise might lead to public conflict or extremely high social cost.

At the local level, in particular the urban or conurbation level, the Transport Structure Plab provides the incentives as well as the boundary conditions for local government to optimally implement its mandate; incentives and conditions which are components of the coordination rules and procedures between central and local government.

A Transport Structure Plan also has the function of instrument for public debate, as there will be conflicting interests between parties such as central and local government, public and private sector agencies, and suppliers and consumers of transport services. It is extremely important to focus upon the different interests and problems of various groups in society and to let such interests weigh heavily when preparing a plan.

The preparation process of, and the public debate on, the Transport Structure Plan also brings out the interfaces between the transport sector and many other sectors. The Transport Structure Plan may, or rather should, have counterpart structure plans for other

(utilities) sectors, such as an Energy Structure Plan, a Water Resources Structure Plan, so on. Other infrastructure sectors are also laying physical and financial claims on the future.

*Scale*. In most countries (in Bangladesh, for example, with its 120 million inhabitants) the Transport Structure Plan would be prepared with only one level in mind—the National level. An important concept, however, to be introduced later is that of the *Transport Region*.[2]

In some countries (India, China, Indonesia) there will be a need for a two-tier system, national and (federal) state level (with the Transport Region concept adopted within the state); in the case of Indonesia, for instance, the national-level would concern (only) inter-island navigation and aviation (and telecommunications), whereas the state-level approach for Java (Indonesia's most-populated island) would be similar to the national-level approach for Bangladesh.

*Revision interval*. The Transport Structure Plan is a framework for long-term considerations; it is a product of the sustainability-way-of-thinking, with the primary function to create large(r)-scale general-public awareness and debate on this way-of-thinking. The "Plan" in Transport Structure Plan may be misleading; it is plan in the sense of an outline.

It includes a number of traditional measures in the form of infrastructure construction and extension and upgrading with rather long gestation periods. Therefore, revision of a Transport Structure Plan every 10 years seems a proper interval. This does not mean that positive results, for example in the areas of (urban) traffic management or improvement of public transport and environmental amenity, cannot be achieved in the shorter term. On the

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[2] Under Problem/Policy area 1.2. Institutional and legal framework: Transport Region concept (page 21).

contrary, the chances of long term success depend to a significant degree on the results achieved in particular areas in the short term. It is extremely important that the short-to-medium term (five year) investment plan (the absolute maximum to which a Cabinet can commit) and the Annual Budget will adopt and reflect the philosophy of the Plan.

*Democratic polity*. A pre-requisite for public debate is the existence of more or less democratic decisionmaking bodies and procedures. It must be possible to have informal and formal fora for discussing future problems and envisaged solutions and strategies to resolve them. The public debate must be properly organized, for example, according to a special procedure (which in The Netherlands is) called a 'Crucial Planning Decision'(see Annex A for a brief description of the Crucial Planning Decision-procedure).

A Crucial Planning Decision would finally become a Cabinet document, supported not only by the sector minister (the Minister of Transport in this case of a Transport Structure Plan) but submitted to the Parliament on behalf of the Minister of Transport as well as (for example the Ministers of Land-use (Physical) Planning, of the Environment, of Home Affairs and the Minister of Finance). This is the moment when a *Plan* becomes *Policy*.

The Crucial Planning Decision retains its validity even after a change of government—just as a law remains valid—in order to provide necessary security, in particular for long-term investments.

The Transport Structure Plan philosophy outlined in this paper is based on the practice developed in The Netherlands since about 1975, with the first (Draft) Transport Structure Plan (policy intentions) being submitted to Parliament in March 1977 and finally approved in 1980/81. The second (Draft) Transport Structure Plan (policy intentions) was

published in November 1988 and finally approved in 1990.[3]

The country's political system and its public administration must satisfy certain standards in order to establish procedures of this kind. Where this is not yet the case, Institutional Development and Education, and Legislation and Law Enforcement will be a major problem area of a Transport Structure Plan.

**Major problems ahead**

Accessibility becomes a major problem when it is or becomes so poor that useful activities cannot be undertaken. Accessibility is a problem (for certain individuals or households) because it is virtually absent or miserable in comparison with other people or groups, or it may be a problem of affluence such as masses of motorcar-users attempting to use the same roadspace at the same time, yielding severe congestion. Mass-motorization and heavy use of motorcars in particular has, because of the characteristics of the cars, resulted in serious, negative impacts on the environment and on the quality of life. The tragic paradox is that (individual) modes of transport that are an asset to quality of life threaten or tend to destroy the quality of life due to their numbers.

Transport activities of the four principal modes (marine and inland water transport, rail transport, road transport, and air transport) have a unique range of environmental effects on:

- air (pollution, locally and globally),

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[3] "Second Transport Structure Plan: Transport in a Sustainable Society," Part D: Government Decision, submitted to the Second Chamber of the States General, session 1989-90.

- water resources (pollution of surface water and groundwater with hazardous substances, modification of water systems, water tables, and drainage),
- land resources (land taken for infrastructure; dereliction of obsolete facilities; pollution of land with hazardous substances; and extraction of infrastructure building materials).[4]

Moreover, these transport activities create:

- solid waste (vehicles, wagons, craft, and equipment withdrawn from service; abandoned infrastructure spoil; and waste oil products),
- noise and vibration,
- risk of accidents (deaths, injuries and property damage; escape of hazardous substances),
- other impacts (partition or destruction of neighbourhoods, farmland or wildlife habitats, congestion).[5]

While continuing and encouraging improvements (already underway during the past 15 years) to reduce these environmental effects, more radical changes—a whole rethinking of transport systems—is considered necessary. The degree and rate of the improvements achieved during the past two decades simply cannot keep up with the pace of (expected)

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[4] "Transport and the Environment: Facts and Figures" *Industry and Environment* (United Nations Environmental Programme IE/PAC) 16 (January-June 1993): 3-6.

[5] In the European Union road accidents kill 50,000 people every year and injure another 1.5 million; in (most) developing countries, fatalities and injuries—on a per million vehicle-kilometers basis—are multiples of this figure.

growth of the compound negative impacts.[6]

Improvements already underway (mostly in industrial countries) that should be continued, be accelerated (everywhere), or introduced (in developing countries) are:

- clarifying the environmental costs of transport,
- setting and enforcing strict emission standards,
- ensuring (enforcing) proper maintenance of existing vehicles,
- stimulating the development and use of less polluting new vehicles,
- giving strong, targeted support to efficient new (mass-transit) systems.

Therefore, *accessibility* and *environment and amenity* are clearly major problem areas within the context of long-term Transport Structure Plan addressing questions such as:

- is there a balance between individual opportunity the freedom, accessibility, and environmental amenity?
- how can we conceive and build a transport system that does not shift the burden of environmental problems onto future generations?

Many developing countries, however, have other pressing transport problem areas. For example, a significant part of the transport network (particularly the road network) is in bad condition because of the lack of timely conservation measures. Roads, in particular, seem to be subject to an inexorable cycle of construction, inadequate or nonexistent conservation, deterioration, collapse, and reconstruction.[7] The tendency to automatically replace the old

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[6] In particular, under prevailing policies, many more Asians can be expected to be living in larger and larger cities, and driving more and more private cars.

[7] United Nations Economic Commission for Latin America and the Caribbean (ECLAC), "Roads: A New Approach for Road Network Management and Conservation," Santiago, Chile: ECLAC, June 1993.

with something new still seems to prevail, with little or no interest in conserving what already exists. This situation has two main causes: the absence of a system ensuring adequate financing for transport infrastructure (in particular roads) conservation; and the ineffectiveness and inefficiency of the agencies responsible for transport infrastructure (roads).

It is important—and one of the major problems—to establish the size of the transport infrastructure network (roads, railways, inland waterways) for which conservation or maintenance can be guaranteed. In this respect, one has to consider (and accept) that conservation of the transport infrastructure generally cannot be financed from the general budget, but will require *cost recovery* from the users of the infrastructure. Therefore, establishing the financially sustainable infrastructure network size is a problem area to be addressed in a (first) Transport Structure Plan.

All efforts of developing the transport sector, starting from the main problem areas indicated above and including domestic expenditure and external assistance (loans and grants from multi- and bilateral donor agencies), are grounded in an institutional and legal framework designed to enable and promote effective and efficient delivery of services. The development of this necessary institutional and legal framework represents an overarching main problem area that must be tackled before the other problem areas indicated can be addressed.

**Effective strategies**

The concept of the *sustainable society*,[8] that is, a society that meets the present generation's needs without jeopardizing future generation's ability to meet theirs, calls for adequate, sustainable institutions. These institutions must understand the concept of the sustainable society in all its aspects, and be fully aware of and understand the underlying causes-effect relations; they must be capable as well as prepared to make decisions consistent with the diagnosis and goals, often in dialogue with countervailing powers.

*Developing the institutional and legal framework*

Weak institutional and general capacity for management and administration is the most important obstacle for implementing economic and other policy reforms. Before embarking upon the kind of policy (reform) initiative implied in a Transport) Structure Plan, it is imperative to review the state of the institutional environment that is supposed to prepare and implement that Structure Plan.

An institutional assessment seems a prerequisite for determining the chances of success for creating and, more important, for implementing a meaningful Transport Structure Plan. Institutional assessment would inter alia address among others, questions on the degree

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[8]Ref. Transport Structure Plan No. 2 (TSP-2) of The Netherlands: "The implication is that we must develop a transport system which does not shift the burden of environmental problems onto future generations" ... "it implies setting limits on the external effects of our transport system: on air pollution, on energy consumption, on the consumption of (urban) space, on the erosion of the quality of urban life, on the numbers of accident victims..."

of political participation of citizens in government and decisionmaking, on transparency of the decisionmaking processes, on possibilities to call government bodies to account, and on the existence of solid, generally valid proprietary right(s); these are basic pillars of a democratic society. Good governance, however, requires not long a certain degree of democratization, but also good management.

Institutional development, in the sense of ensuring a more purposeful and effective functioning of **organizations**, implies that the external relations of these organisations become stronger and that the internal tasks of the departments and their employees are clarified and coordinated—all to achieve the organisation's objectives.

The decentralization of government administration and finance is especially relevant for the (transport) infrastructure sector. Particularly where manufacturing-led economic growth has accelerated urbanization and generated a steady rise in real disposable income, there has been a steep demand for public services, including transport infrastructure and services, in cities and towns. The size of many developing countries, the regional diversity of the population and resource base, and substantial spatial variations in development needs suggest that the magnitude of investment- and service-provision capacity to meet this mushrooming demand cannot be managed effectively by relying on a highly centralized system.[9]

Decentralizing infrastructure planning and implementation to make better use of available resources is a strategic issue in a Transport Structure Plan. It may be implemented in a rational and incremental fashion, if a majority of the relevant ministries can agree that

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[9] Smoke, Paul and Johan Bastin, "Decentralizing Regional Infrastructure Planning and Finance in Indonesia," Harvard IID Development Discussion Paper 469, September 1993.

certain local governments are worthy of greater authority (autonomy).

Institutional change, decentralizing government administration and finance, introducing new land-use planning regulations or cost-recovery mechanisms and other institutional reforms will all require adjustment of existing or new legislation, which in turn can become effective only if appropriate law enforcement is properly embedded in the respective institutions.

Developing countries will exhibit varying domestic capacities to prepare and implement a Transport Structure Plan. More importantly, the political will to start preparing a Transport Structure Plan must be domestically based. Nonetheless, the decision to begin the process might be triggered by good examples from other countries.

The first strategic question is whether or not—and if so, to what extent—the decision to embark upon a Transport Structure Plan-process needs to be accompanied by training or education or both for institutional capacity building within the Transport Structure Plan context.

Creating the substantial institutional support necessary to get a meaningful Transport Structure Plan off the ground will be a timeconsuming affair. It may take up to ten years, or about half the time perspective of a Transport Structure Plan (20 years), before the desired workable institutional and legal framework has been domestically created. Yet, in view of the overall objective of a sustainable society, the effort seems worthwhile, even though the first Transport Structure Plan may remain a defective, draft Plan for the first ten years.

*Establishing a financially sustainable infrastructure network size*

The starting point for future, long-term, perspective planning must be concrete. What type and size of transport infrastructure networks can realistically be taken into long-term consideration? What parts, if not all, of the present systems can be realistically maintained? It serves no practical use to speculate about the long-term future of parts of the systems are not financially sustainable, because these will not be in use when the long term arrives!

Developing a sustainable infrastructure network requires the following strategies

- Adopt the principle that the user pays the long term marginal costs of the infrastructure; this is consistent with virtually all structural adjustment programmes, recently implemented or in various stages of implementation in developing countries. Applying this principle has consequences for the level of various tariffs and taxes, which in turn affects the total taxation burden of certain groups of the population. The possibility of covering the costs of infrastructure conservation from an Infrastructure Fund is an option worth investigating.

- Determine the infrastructure network links that are indispensable (in the present situation and the near future) and can be kept in good operational condition, and decide what should happen with the rest. In many cases, the level of infrastructure provision must be related, more closely than in the past to the economic carrying capacity. Sometimes this involves difficult choices primarily choices made in favor of infrastructure links that effect production and employment, that is, infrastructure

essential for the accessibility of residential and production areas. Such links provide the economic carrying capacity for conservation cost recovery. Similarly, streets in urban residential areas can be kept in working condition only if the residents themselves are prepared to make contributions in the form of land and property taxes.

- Establish the infrastructure asset value of the network as a function of its present condition.[10] This will make it possible to calculate the costs of rehabilitation or reconstruction of infrastructure in poor condition to a standard where it can be conserved; in other words, parts of the infrastructure network that are deteriorated need to be restored in a conservable condition, often at high costs, before these can be reincorporated in the conservation stock. At the same time, it may be necessary to reconsider the infrastructure's design standards, both in terms of capacity and structure, in view of its economic function (for roads with would mean the width and foundation)[11]. The aim would be to minimize repair and conservation costs.

*Trading off accessibility*

Accessibility is the lubricating oil of the economic and social processes taking place in a country; it is increasingly essential for their operation as the processes get more complex. Moreover, the importance attached to accessibility is likely to increase with increasing affluence and is often translated into *automobility*.

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[10] For a possible, simplified methodology see Reference under footnote 7.

[11] Building a (rail)road without an adequate, functional foundation is akin to carrying water to the sea.

Particularly in developing countries, a degree of equity plays a crucial role in maintaining social sustainability. Current transport policies tend to favor car ownership and use for the elite, with a disproportionate amount of public money going to imports of low-taxed fuels, vehicle components, and urban road infrastructure. The majority of citizens do not, and will not, own cars and receive no benefit from the public subsidy.[12]

Experience has shown that measures to improve accessibility, particularly by concentrating on optimal service to automobility, are likely to clash with the goal of a sustainable society[13]. The notion of the sustainable society places limits on the extent to which the transport system can be allowed to serve narrowly economic and social goals. The challenge now is to find intelligent and creative solutions for transport problems by looking at long-term, integrated, alternative options instead of short-term, piecemeal, individual interventions.

Each transportation option involves a complex web of socio-economic, political, environmental, and financial considerations with the following main strategic aspects:

- Demand side management looks at the source of accessibility, at human behavior patterns affected by land-use and city settlements design, the location of economic activities and employment centres, and social mores regarding the comfort and prestige of vehicle ownership and use related to ability or willingness to pay.

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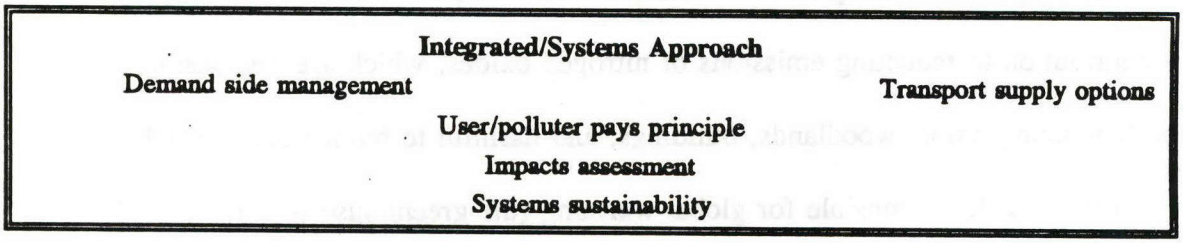
[12] Birk, M.L. and P.C. Zegras, "Moving toward Integrated Transport Planning: Energy, Environment and Mobility in Four Asian Cities," IIEC March, 1993.

[13] The challenge of a Transport Structure Plan (for example, the TSP-2 of The Netherlands) is finding intelligent and creative solutions for transport problems that allow economic development in the context of a sustainable society, such as: a safe and attractive urban cycleways' system tailored to the (longer distance, rapid) public transport system; and combined railroad or waterway-road transport and terminals and a coherent information system for the management of freight transport.

- Integrating a portfolio of options to supply effective transport services, differentiating between international, interurban, rural, and urban transport systems, and between passenger and freight transport. In comparing the options, transport planners need to adopt a systems approach, for example incorporating the role of non-motorized transport and long-range land use.
- Once the variety of options has been formulated, a process of evaluating their effects can begin. Based on "User/polluter pays principle," the consequences or impacts can be demonstrated in terms of accessibility, social conditions (equity considerations, focusing on people transported rather than vehicles moved), and ecological sustainability (energy use analysis and internalizing environmental costs).




*Giving due consideration to environment & amenity*

Studies, research, and publications consistantly demonstrate the significant role of the transport sector in current environmental problems. It is not only the transport industry's current size (more than 500 million motor vehicles in the world, 400 millions tons of freight transported annually, and about two trillion passenger-kilometers by civil aircraft) but also its continued rapid growth that makes it a crucial environmental issue. Particularly in developing countries, where the level of transport provision is much lower, transport is expanding at an extremely rapid pace. Car sales in Malaysia, for example, rose by more

than 70 percent annually at the end of the 1980s. The motorcar population is growing faster than the human population.

Transport damages the environment in three ways: by air pollution (and pollution of water and land resources), noise nuisance, and fragmentation of city- and landscape. All means of transport cause environmental problems, although the contribution of certain types is more damaging than that of others. Motorcars use by far the most energy and discharge the most harmful matter. An increasing automobility, increased freight transport by trucks, and further growth of aviation, are likely to lead to a further growth in energy consumption and emission of detrimental gases.

These problems have been recognized for some time, and many technical, partial solutions have already been developed. The catalytic converter, for example, will provide a significant contribution to reducting emissions of nitrogen oxides, which are responsible for acidification (damaging crops, woodlands, buildings, and harmful to human and animal health); of carbon dioxide responsible for global warming (the greenhouse effect); and of volatile organic hydrocarbons. In addition, the automobile industry has made important research efforts and obtained significant results in developing more efficient engines and lighter vehicles.

Continued growth in car ownership, rapid growth in car use, and a trend toward more powerful cars with increasing affluence, however, are likely to have the aggregate effect that environmental goals on emissions reduction of harmful matter will not be met either worldwide nor nationally. Technical solutions alone will not be enough to resolve national environmental problems.

A continuous expansion of the transport infrastructure, in particular finely-meshed networks of wider roads, entails an almost irreversible fragmentation of urban areas or the rural countryside. This fragmentation creates physical and visual barriers (in addition to noise and exhaust fumes) for local communities receiving little or no benefits from the facilities.

How should these environmental problems be tackled if they are not mainly or purely technical problems?

A useful strategic framework for analyzing environmental problems is the social dilemma framework, which holds that the outcome of all sorts of decisions or behavior is strongly affected by the fact that the benefits of the choice are reaped by the decisionmaker, whereas the disadvantages or damage can be shifted off on to others; the others being society or the next generation[14]. Environmental problems are therefore problems of "passing the buck." Problems thus could be resolved by breaking this mechanism—but that is easier said than done, because it is deeply rooted in society at large. There are four main reasons for this:

- the scale of many environmental problems (such as climate change and acidification), which makes isolated, local solutions almost meaningless, whereas it is very difficult to reach agreement in an international context on the seriousness of the problems, let alone on their solutions,
- the time it takes before environmental problems become manifest (long-term), which generally is much longer than the time horizon of enterprises or individuals (short-

[14] G.W. Fiechter, "Oplossing milieuproblemen verkeer en vervoer ligt niet bij techniek alleen" *De Ingenieur* Number 6, 1993. (Netherlands' Professional Journal).

term),

- conflict of interest and competition (for example, in freight transport) that make restructuring difficult (politics or lobbies and unions obstructing changes),
- the true costs of transport are not sufficiently visible to the user, who is not charged the full costs (see the section on trading off accessibility).

Problemsolving strategies will be needed to address in an integrated fashion the issues of technology (such as downsizing engine power, cylinder volume, and vehicle weight); organization (for example, public transport system, goods distribution in inner cities, and land-use structure over the long term); and behavior (changing moral values).

**Translating strategies into targeted scenarios**

Table 1 summarizes four main problem or policy areas and fourteen possible problem solving strategies.

The next step must be to give the fourteen broad strategic approaches addressing the four main policy areas a more concrete form. Ideally, it should be possible to draw up a series of targeted scenarios, with achievement defined in measurable indicators.[15]

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[15] The implication is that organizations,responsible for measurement of indicators are in place and functioning well; whenever this is not yet the case, there is another target under institution building and upgrading.

**Table 1. Problems and strategies for a Transport Structure Plan**

| Problem Area | | | |
|---|---|---|---|
| Institutional and legal framework | Sustainable networks | Accessibility | Environment and amenity |
| Strategic Approaches | | | |
| Assessment institutional framework | Assessment functions and asset value of infrastructure | Demand side and mobility management | Land-use planning and control |
| Decentralization govrernment administration and finance | User/polluter pays principle and infra-structure fund | Alternative supply options | Technology innovation |
| Legislation and law enforcement | Design standards revision and network reclassification | Assessment of impacts | Organization change |
| Training and education for institution building and upgrading | | | Behavior change |

In many cases the measurable achievement may be expressed only in relative terms, that is, as an improvement compared with an earlier quantified situation. At the same time, many of the intervention strategies are not strictly limited to the policy or problem area under which they are listed in the diagram, but rather they cutting across two or more of the interrelated policy issues.

It is not possible or appropriate here to present concrete qualtified targets for a variety of situations in a variety of developing countries. Figures are mentioned purely for illustrative purposes.

The more detailed interventions or strategic approaches are presented under the headings of the four main problem or policy areas, though there is a great deal of interaction

or interrelationship (or both) between the areas. The structure created in this way allows *packages of measures* to be compiled for certain intermediate target years (table 2). Such integrated packages would include elements from all four major areas: strengthening institutions and improving the legal base; ensuring quality of sustainable transport network systems; redistributing and providing alternative accessibility; and emphasizing and internalizing environment and amenity norms and values.

**Table 2. Targeted Strategies for a Transport Structure Plan**

| | Problem area | | | |
|---|---|---|---|---|
| Measures | Institutional and legal framework | Sustainable networks | Accessibility | Environment and amenity |
| | Institutional reform: legislation and decentralization | Financing principles: User/polluter pays | Rethinking mobility | Environmental plan preparation |
| | Transport region concept; Company transport plans | Sustainable networks size | Urban re-modeling and land-use planning and control | Restraining car ownership and use |
| | Cooperation among transport organizations | | Urban tranport<br>• Collective transport, bus, rail, combined<br>• non-motorized transport and intermediate means of transport<br>• Freight transport | Reducing vehicle emissions<br>• fuel efficiency<br>• clean fuels and fuel switch |
| | Transport sector legislation and regulations<br>• enforcement mechanisms | Transport infrastructure fund | Interurban transport<br>• freight transport<br>• passenger transport | Road safety<br><br>Transport of hazardous materials |
| | Research on transport and infrastructure | | Rural transport<br>• non-motorized transport and intermediate means of transport<br>• funding | |
| | Communications and education<br>• press and media<br>• school curriculum | | Private car commuting efficiency<br>• car sharing<br>• park & ride<br>• high occupancy vehicle lanes<br>• tele-working | Cutting noise levels |

*Institutional reform*

More important than anything else is that *insiders* understand the transport problems, develop mechanisms to articulate these in a professional way, and find ways to implement appropriate policies.[16] *Decentralization* of and *participation* in decisionmaking processes are essential to improve the planning and implementation of overall transport infrastructure and services. Central government holds the key to develop and implement guidelines for assigning responsibilities and financing sources across lower government levels.

Supposing that the political will exists at the Cabinet level, decentralization will first require new legislation. Capabilities and the capacity to prepare such legislation must be available—or must be rapidly developed—in various ministries concerned, for example the ministry of transport, ministry of home affairs (or the equivalent in the local government), and ministry of finance[17]. The latter ministry is particularly important because there can be no true decentralization without delegation of powers to local governments to decide on finance.

Whereas central government (ministry of transport) will certainly retain responsibility for the national transport infrastructure networks (interurban highway system, interurban railroad system and national inland waterways system, if existent), the transfer of lower classified transport links must be legally arranged (for example roads and inland waterways

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[16] In the 'global village' we tend to come physically closer and closer to far-away 'neighbors,' and are tempted to impose our way of thinking out of self-interest.

[17] A ministry of transport responsible for the integrated planning and coordination of the various modes of transport should be establishedif one does not already exist. Alternatively, an "Integrated Transport Planning Authority" may be created as an interim solution, provided that this Authority would be placed directly under a key cabinet minister (such as the Minister of Planning).

to provincial or district government and rail branchlines to private users). Financial arrangements are like to accompany such legal arrangement. Central government may still collect all user charges by general arrangement (such as a fuel surcharge or road tax) and must compensate the new local administrator, now responsible for the conservation and management of the transferred facility. Such financial arrangement must be part of the legislation. An agreement on the condition in which the facility would be transferred would also be required, so that the new administrator would not be burdened with an unfair amount of backlog maintenance.

**Table 3a. Institutional and legal framework: Institutional reform**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Institutional reform | • Pilot approach on decentralization<br>• Established legislation infrastructure fund | • Deadline(s) met<br>• Number of local government units covered |

The establishment of dedicated Infrastructure Funds (such as a Road Fund or Railway Fund) may be considered, or one Infrastructure Fund with specific allocation mechanisms, ensuring a fair distribution over the different modes of transport and over various government levels.

Most important is an Infrastructure Fund guaranteeing at least the conservation or maintenance of the sustainable Networks. Central government needs to determine its interurban networks, the conservation of which must be warranted by its share from the Infrastructure Fund. Likewise, lower governments responsible for rural accessibility and urban transport would receive a share from the Fund and in return would guarantee its conservation performance in accordance with the locally determined network priorities.

The local governments (provinces, districts, and municipalities) must be able to adopt these tasks of planning, administration, supervision, and accounting. Apart from the interagency communication and coordination mechanisms (central to local governments) that need to be developed, local governments must create effective, democratic channels of communication with local communities, representing a variety of consumer and supplier groups with an active interest in accessibility and local transport services.

In most countries, none of this will develop overnight. Institutional reform is a timeconsuming process of predominantly organizational change. Even ten years may be for some countries an over-ambitious and optimistic time horizon for changes of this magnitude.

*Complexity of the institutional framework.* Most developing countries do not have clear consensus or a well-defined official position on which ministries are responsible for particular substantive aspects of decentralized infrastructure development—let alone conservation. For example, regional or local government training and institutional development is likely to be in the portfolio of the Ministry of Home Affairs, but it is clear that the Ministry of Public Works (or Transport) and the Ministry of Finance play an important role in technical and financial training and management skills development. Such instances of overlapping jurisdiction of multi-faceted plans and projects are common across—and even within—ministries. In addition to the ambiguities on horizontal responsibilities at the central level, the role of decentralized levels of government and their relationship to central government agencies are seldom clearly and consistently defined. The role of regional or local governments in planning or implementing major infrastructure

development projects is often determined through subjective and uncoordinated assessment of regional or local government capacity by the various ministries concerned.

*Ministerial competition.* There are few, if any, incentives for institutions to work toward better coordination, either horizontally or vertically. Individual ministries and their directorates tend to protect their own interests first, unless there is a mechanism backed by sufficient power and the political will to bring about greater coordination. This is easier with a smaller number of players. Similarly, the central technical departments should not be expected voluntarily to decentralize significant responsibilities to regional or local governments, thereby undermining their own control over financial resources.

Decentralization is defined differently by the various ministries. For the planning ministry it may mean taking better account of regional or local needs in central government projects, but without handing over those projects to the regions or municipalities. The finance ministry may think in terms of fiscal decentralization: strengthening and rationalizing local revenue sources, transferring more funds as untied block grants to regions or municipalities while reducing centrally controlled infrastructure development funding, and increasing the importance of loans. For the home affairs ministry a decentralization program may mean the strengthening of local institutional and manpower capacity to assume tasks currently undertaken by sectoral ministries, but without reducing the home affairs ministry's control over regional and local activities. And the public works (or transport) ministry often equates decentralization with deconcentration: reinforcing the power and capacity of the public works' field offices while limiting the role of regional and local governments to that of a passive project partner.

*Lack of local accountability*. Even if regional and local governments were given more substantive responsibilities, the current system in many developing countries lacks true accountability to a local constituency. Many regional (provincial and district) parliaments or city councils possess neither the political independence nor the technical and administrative skills needed to plan and control regional or local development effectively. Senior regional and local officers feel accountable to the central power base. Their dual role as autonomous regional or local government officials and representatives of the central government prevents effective decentralization, except perhaps in the sense of administrative deconcentration.

*Competing donor interests*. The interests of bilateral donors are not necessarily well served by sectoral coordination and decentralization. Coordination and decentralization are timeconsuming processes that delay the donors' efforts to prepare and approve new projects and spend money. Particular donors may have established client relationships with specific ministries, or divisions within ministries, that have the capacity to process projects and absorb money rapidly; donors may even be in competition in dealing with the most efficient recipients. Client ministries and patron donors may be sharing particular sectoral or geographic interest, which may lead to sectoral and regional biases. Thus, the main obstacles to decentralization are a lack of consensus on the role of key agencies; a lack of effective coordination; inadequate operating procedures and staff; and fragmented and counter-productive relationships between particular donors and specific ministries. Authentic decentralization, requiring gradual capacity building, will reduce donor and central government control over financial resource allocation.

At the *central level* the following "textbook" actions for reform are required:

- determination of the appropriate institutional responsibilities for activities related to regional or local transport infrastructure development or conservation and finance.
- putting in place a viable and properly empowered coordination mechanism for planning and implementation.
- putting in place a clear mandate and schedule for fiscal decentralization, enforceable by a designated coordinating agency.

The following steps must be taken concerning *central-local relations*:

- devolving appropriate functions to regional or local governments according to existing central government legislation and policies.
- extending powers to regional or local governments to raise revenue from appropriate sources (user charges) to cover an increasing portion of capital and recurrent expenditures.
- granting adequate enforcement authority to local and regional institutions, and deterring administrative and political interference in local revenue generation by higher levels of governments.
- distributing central-to-local transfers according to more rational and consistent criteria (such as needs relative to broader development goals and fiscal capacity), using a coordinated system of grants and technical assistance.
- incorporating incentives into the transfers system to improve local resource mobilization.

The following must be developed at the *local level*:

- a local political arena where local leaders demonstrate their responsiveness to their constituents and must bear the consequences of their own mistakes.
- accountability of local decisionmakers to their citizens for the use of the local revenues from user charges.
- local administrative structures for taxation the design and collection of user charges, local budgeting, financial reporting, contracting, and dispute settlement[18].

Genuine interministerial consensus is a fundamental prerequisite to the reform process. This could be achieved earlier if some local governments, identified as particularly capable of exercising greater discretion in fiscal and managerial matters, could be selected to introduce greater degrees of autonomy gradually and cumulatively[19].

A joint representation of ministries would evaluate the performance of the selected local government bodies in the following areas:

- ability to accurately identify needs (demand analysis) and prepare appropriate and realistic transport infrastructure development or conservation plans to meet them (to be evaluated by the planning or transport ministry).
- ability to effectively raise financial resources to share in the costs of providing transport facilities and services (to be evaluated by the finance ministry).

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[18] Richard Bird, "Infrastructure and decentralization - some preliminary reflections," University of Toronto, August 1993.

[19] An inventory of the number of units of regional or local government would be required, and an assessment of their current institutional capability.

- ability to effectively manage the use of financial resources in an accountable manner (to be evaluated by the home affairs ministry).
- ability to design and implement local transport infrastructure development or conservation projects that meet appropriate technical standards (to be evaluated by the public works or transport ministry, or both).

To increase the credibility of this approach, the joint-representation of the ministries might be coordinated by a neutral institution with an independent chairperson.

*Development of the transport region concept*

Once certain progress has been made with institutional reform the concept of *transport regions* can be introduced. Traffic does not respect administrative boundaries: in many situations, the administrative units' boundaries are not suitable for the division or distribution of policy and management functions relating to transport and infrastructure. A collective, integrated approach with horizontal and vertical coordination is necessary for addressing (in the most cost-effective way) transport issues or problems that cross administrative boundaries. This urgently concerns the rapidly growing urban areas most affected by the erosion and inequity of accessibility and quality of life.

The *transport region* concept does not alter the division of functions and responsibilities between the tiers of government (established or adjusted through the institutional reforms discussed above). The job of municipalities or rural districts is to implement local traffic regulations; provinces (if the exist) should initiate and coordinate

action at the regional level (through regional development plans, for example); and the central government is responsible for the national framework.

**Table 3b. Institutional and legal framework: Transport regions**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Development of transport region concept | • Accepted status<br>• Completion of regional transport plan | • Deadline(s) met<br>• Agreement with central government |

The transport region model aims primarily at ensuring close cooperation between the region's local authorities and industry, transport undertakings, and other relevant and interested parties in order to reach a joint regional transport policy in keeping with the Transport Structure Plan objectives.

Central government grants to assist in the preparation and implementation of the regionally coordinated transport plans would be a primary incentive for local (municipal, district, and provincial) authorities to initiate a transport region.

A transport region would be the task of preparing, programming and implementing transport functions (to be discussed further in the section dealing with accessibility), notably:

- the relationship between transport and land-use planning (location of significant economic activities and employment concentrations, public facilities, and residential areas).
- local and regional public transport.
- freight transport, distribution, and delivery.
- non-motorized transport provision (such as bicycling and walking), if possible in relation to the public transport network or freight distribution.

- the road network.
- parking policy.
- road safety.

The goal is for the central government (ministries of home affairs, land-use and physical planning, transport and public works) and transport regions to reach agreements on issues such as:

- the geographical area covered by the transport region (a functional unit in transport terms), giving consideration, to existing administrative boundaries of other policy areas such as housing, police control, and others.
- formalizing intermunicipal cooperation of the administrative subdivisions constituting the transport region; the plans must have an adequate, reliable horizontal administrative foundation at the local level.
- coherence and consistency with the Transport Structure Plan (through the transport ministry's active involvement in the preparation of plans for example through grants, technical assistance, and the steering committee.

Central government should help meet the costs of research (surveys, hearings, analysis) commissioned by transport regions with the goal of accelerating the compilation of regional transport plans.

Based on agreed regional transport plans, central government grants for implementating certain scheduled projects will be determined and included in the Multi-Year

Infrastructure and Transport Plan (covering a four to five year period, equivalent to a normal cabinet period) in the annual budget. *In sum, the transport region concept is an instrument for attaining true decentralization within the institutional reform process.*

Of course, the transport region approach in developing countries, and the institutions it requires, cannot be seen in isolation from *urban management*. The Urban Management Programme of United Nations Development Programme, the United Nations Commission on Health and Safety, and the International Bank for Reconstruction and Development is a global technical assistance program aimed at building local capacity for resolving the broad range of urban management problems. The Programme which has been running since 1986, addresses main issues, including:

- urban land management,
- urban infrastructure,
- municipal finance and administration,
- urban environment (since 1990),
- urban poverty alleviation (added in 1991).

The Programme organizes city and country consultations with local and national representatives (upon request of the latter), and it has created regional panels of experts for each of the five thematic areas mentioned above, who assist the local authorities in developing specific policy and action programs for a particular country or city. The Programme is managed by regional coordinators (for example residing in Kuala Lumpur, Malaysia or Quito, Ecuador), supported by nucleus teams (operating from the United Nations

Commission on Health and Safety in Nairobi, Kenya and International Bank for Reconstruction and Development in Washington, D.C.). The position and role of urban transport may have to be articulated more in the Urban Management Programme than it has been until now. The limited degree of local participation and donor-driven approaches are among the Programme's weaker features.

*Introduction of company transport plans*

Demand side management or managing mobility cannot be achieved without the support and help of the people causing a significant part of the traffic problems: large employers and their employees. Travel-to-work issues should become a company's management concern, just as environmental issues should become part and parcel of the internal concerns of institutions and companies.

*Company transport plans* that consider the workforce travel pattern as a whole could be initiated by the institution's or company's management and be put on the agenda of negotiations with unions or other representative bodies for employees. The plans should attempt to find the best arrangements from the perspective of individual cost savings and minimal travel distance and travel time (systems approach) and of contributing to the company's code of good environmental conduct. Various transport alternatives to the use of employees' personal carsshould be considered: company transport, collective subscription to public transport, non-motorized transport (cycling), and car-sharing arrangements.

To broaden the user base of certain facilities, groups of employers in a particular

urban or industrial area may draw up joint transport plans. A nominated transportation coordinator would collaborate with individual firm or institution's transport managers in designing a transport plan for all employers in the area.

**Table 3c. Institutional and legal framework: Company transport plans**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Introduction of company transport plans | Government institutions and private sector firms with more than *y* employees; later include employers with less than *y* but more than *x* employees | • Target year in which identified government and private employers mush have company transport plans ready. |

The process of preparing a company transport plan will create awareness as well as controversy and will promote participation in the debate on accessibility and environmental impact. The task of encouraging the employer-focused approach will have to be undertaken within the context of the new transport regions, with the appropriate local authority acting as the task manager. The company transport plans will provide insight regarding the transport implications of company locations, one of the primary variables for urban land-use planning; this is another reason to have the local authorities intimately involved in this subject area.

*Cooperation among transport organizations*

The state or central government's role is concerned with infrastructure provision and establishing frameworks for operators providing transport services. In other words, the state in principle is not actively involved in operating and owning transport services: the state should not be driving its own vehicles, plying its own ships, or flying its own airplanes. But central government is responsible for initiating the "right" processes and, moreover for

promoting these processes with transfers of financial resources and legal powers.

**Table 3d. Institutional and legal framework: Cooperation among transport companies**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Cooperation of company transport plans | Formal cooperation agreements between either mono-modal or inter-modal transport operators, freight or passenger information systems technology | Deadline on agreements met |

The quality of passenger and freight transport services depends to a great extent on the quality of the transport industry's labor force, which is in turn determined by the nature of the work required, the working conditions and labor relations. The availability of qualified labor and terms of employment offered affect the supply and demand situation and the price of labor. Similar branches of transport industry should be less fragmented and should become stronger negotiation partners for local authorities and the political system. The common interest of the branches and their tasks within the transport region concept (regional transport plan) should be well represented; optimal feedback to their constituencies (employers, unions or other worker representation, and the work force at large) is equally important for achieving a broad platform to implement changes in transport services.

A closer relationship between the transport undertakings and the government, particularly at the regional (urban or rural) level, raises the question of the extent to which transport undertakings or entrepreneurs in a region can or should work together and of the type of organization that they should adopt for that purpose: complementarity or additionality in the former, and substitution or competition in the latter.

The natural self-interest of individual public transport undertakings that result in badly

coordinated services impedes an attractive, customer-orientated image. Lack of integration of planning by local governments and of operations by transport undertakings or entrepreneurs causes great problems first in metropolitan areas. Moreover, the different terms-of-employment regimes within a transport region are likely to have an adverse effect on labor relations in urban and regional transport. The transport region forum, where the company transport plans are also an important input, seems an appropriate place to bring about improvements in these areas. The temporary use of subsidy may give the government a significant say in qualified labor availability and terms of employment.

Greater customer-friendliness can be achieved by making optimal use of the attainments of modern information technology. A coordinated approach by various complementary or intermodal transport suppliers developing and operating integrated travel (transport) information systems could first clarify and then help eliminate gaps and uncertainties experienced by client groups.

As part of the pilot approach to institutional reform, central government may take the initiative—within a transport region context—to study, jointly with the public transport operators' representatives, the management structure changes required in a Transport Structure Plan. The results of the study would eventually be incorporated in new or amended legislation (**Passenger Transport Act** or **Freight Transport Act**).

*Transport regulations and their enforcement*

Most countries have overarching legislation, (for example, Passenger Transport Act and Freight Transport Act), which regulates private entrepreneurial activities in the transport

sector on major issues, including:

- entry to the sector (registration, and concessions or licences).
- duties and rights of entrepreneurs (services to be supplied, vehicle specifications, tariffs and subsidies, professional operator or carrier qualifications).
- sanctions in case of non-compliance (renewal or withdrawal of concessions or licences).
- coordination and communication mechanisms with the government (commissions in charge of execution of the respective acts).

**Table 3e. Institutional and legal framework: Transport regulations and enforcement**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Transport regulations and their enforcement | Completion of new regulation, such as road traffic regulation, administrative enforcement of Traffic Regulations Act | Time schedule(s) and deadline(s) met; enforcing agencies operational |

In addition, 'micro-level' legislation regulates the behavior of operators and individuals on the roads. This includes a Road Traffic Act with road traffic regulations or a traffic code of conduct for all types of road users.

An integrated transport policy will probably not function well without various regulations and restraints: various pricing measures, vehicle specifications, speed limits, car parking restrictions, reservation of traffic space (special lanes) for specific vehicle types, and so on. Unfortunately, most transport users will not automatically comply with rules and regulations, particularly not when these conflict with their immediate personal interests.

If rules and regulations cannot be made clear and comprehensible enough that the

public sees compliance as natural and proper, an appropriate enforcement system will be necessary. Introducing rules and regulations that will not or cannot be enforced is a wasted effort (and a waste of scarce intellectual resources).

In the numerous situations where individuals, though they understand the purpose of a rule or regulation, nonetheless seek to evade it, there are three ways of tackling the problem:

- preventive measures in the form of technical or physical restraints (usually the most effective, and thus prefered method).
- deterrent measures that call for surveillance and, where regulations are breached, sanctions (these placing a heavy burden on enforcement capacity and the judicial system though there are ways of replacing criminal law procedures with administrative sanctions).[20]
- administrative measures, calling for the comparison of different sets of records (databases on taxation, vehicle testing, and insurance, for example).

*Fundamental and strategic research on transportation and infrastructure*

The current situation in many developing countries indicates a lack of government concern for strategic and innovative research on transport demand and infrastructure supply, a lack of government support for long-term research, and fragmented and adhoc research efforts.

Responsibility for departmental coordination and coherence of transport research

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[20] An Administrative Enforcement of Traffic Regulations Act may provide municipalities/police/judicial authorities with the effective instrumentation for enforcing traffic rules, including parking restrictions, without 'going to court'.

efforts should be concentrated in one organizational unit. Research for the short- to medium-term must be clearly distinguished from long-term research efforts (through separate budgets), without losing oversight and cohesion. Longer term research must take an integrated approach that considers land, water and air transport from the policy perspectives of accessibility, safety, and ecological, financial and social sustainability. More attention should be given to alternative policy options and to quantifying impacts. A system of project grants for fundamental and strategic topics may be advocated rather than basic funding of research institutions.

**Table 3f. Institutional and legal framework: Research on transport and infrastructure**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Fundamental and strategic research on transportation and infrastructure | Research program prepared jointed with universities, research institutions and other interested parties | Budgetline in annual budget of the ministry of transport. Defined output with time schedule and deadlines met. |

A lead agency, for example the research department of the ministry of transport, which would be supervised by a multi-disciplinary 'Research Programme Council' while preparing the research program, should seek inputs from all relevant parties: other ministries including the ministry of education; local governments; universities; and research institutes.

The draft research program should bring together the economic, social, environmental, and technical aspects of transport, emphasizing the role of technology as a means for responding to economic, social, and environmental demands (rather than pushing supply-driven applications of technology).

There should be an annual research budget allocation, including a multi-year budget

outlook to guarantee continuity, and a designated permanent research management organization to ensure adequate staff time allocation.

*Influencing behavior through communication and education*

The function of the first Transport Structure Plan is also—and probably primarily—to create greater public awareness of transport issues such as inequality in accessibility and mobility, the consequences of mass automobility, the role of land-use planning, and others.

The role of the ministers and other local opinion leaders in not only advocating but also acting in accordance with the principles of the Transport Structure Plan are important for placing Plan issues visibly on the political and social agenda.

**Table 3g. Institutional and legal framework: Communication and education**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Influencing behavior through communication and education | Changes in modal split or share of each transport mode, public understanding of the Transport Structure Plan | Measurements in various surveys and panels, appearance and reactions at consecutive public hearings/addresses |

The media (press, radio, television, and film) should play a role too in facilitating participation and opinion-forming. When attempting to influence behavior, basic principles of a potential to change and willingness to change must be kept in mind. Potential to change is usually high if there is trust in leadership, clear and well-communicated objectives, and clear and well-understood strategy. Willingness to change is usually high if enough, but not too much, time is given to adapt, and if there is sound technical preparation, regular communication and information, room for adjustment during the process, and only one far-reaching change at a time.

Results from continuous or regular travel survey panels, that is a representative composition of people (poor and rich) who are questioned about their travel habits and frustrations, thought primarily for transport planning purposes, may also be used for public information and raising awareness[21].

Information networks, for example those originating from global or regional program of multilateral donor agencies such as the Urban Management Programme,[22] or the Second Transport Decade[23] or created by non-governmental organizations such as the International Forum for Rural Transport and Development,"[24] can be helpful in providing public information relating to:

- land use and land use planning as a constructive transport planning tool, and the perspective that urban remodeling schemes offer.
- understanding travel behaviour in the broader context of daily activities and the constraints facing individuals.
- reforming transport systems to serve the population as a whole rather than favoring particular user groups, which requires different perceptions and attitudes of important decisionmakers on the transport scene.

To be effective, information network "products" need to be made more accessible for a

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[21] The transport planning purposes relating to "strategic research," the problem area discussed above.

[22] Ref. problem or policy area discussing the transport region concept.

[23] UN-supported programs coordinated by Economic and Social Commision for Asia and the Pacific, Economic Commission for Latin America and the Caribbean, and ECA.

[24] Ref. IFRTD-secretariat run from UK and Geneva (International Labour Office).

greater range of transport user groups, involving a greater variety of local experts and journalists.

Apart from behavior or attitudes toward mobility and accessibility issues (the problem of bridging distances), there is the problem area of user behavior in traffic situations. Traffic education for the public begins at home and at school, therefore government should take road-safety education (such as Traffic Code of Conduct) seriously and ensure its integration in the school curriculum.

As far as drivers (of various vehicles) are concerned, many developing countries must resolve the two-tier problem of producing able drivers through regulated instruction and examination, satisfying certain quality standards, and creating a professional mechanism for driver education, notably instructors meeting specific skill requirements through compulsory in-service training and formal licensing. The motorcyclist population, a fast growing user group in many developing countries, will probably require particular attention in terms of traffice education.

*Adopting sound principles for financing transport network conservation*

Transport infrastructure, and roads in particular, provides a public service and can be compared to other public utilities such as water, electricity or telecommunications. The users of these services pay a rate that comprises the income for the utility company. The company may use that income to provide water, electricity, and so on as it chooses, usually with few restrictions. A government normally cannot interfere with the utility company's use of these funds.

**Table 4a. Sustainable transport networks: Principals for financing conservation**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Adopting sound principles for financing transport network conservation[25] | Transport infrastructure user charges, conservation costs | Public information on user/polluter pays principle, deadline met for introducing user/polluter pays principle |

Rates for services are thus quite different from taxes, which are usually part of general government revenue and are not earmarked for any specific type of expenditure. Taxes finance certain sectors or activities that are deemed essential by society but that cannot generate sufficient revenue for self-financing and thus require subsidies: basic education, basic health, national security and defense, and public administration.

*No subsidies for transport infrastructure conservation.* Many developing countries, especially those with centrally planned economies, have considerably increased the number of subsidized sectors by incorporating sectors such as urban transport and housing. Most countries that have fallen victim to prolonged financial crises however, are beginning to recognize that many sectors cannot continue to be subsidized from limited, general tax revenue. In this respect, the road transport system should not be considered a subsidy sector, because it is not dependent upon funds raised in other sectors of the economy. The conservation of the transport network could be financed through rates paid directly by the system users.

*Fund raising from users.* Financing transport infrastructure conservation by charging rates, while periodically adapting the level of charges to conservation needs, forces the users of the system to be aware of the relation between conservation spending and the level of user

[25] See footnote 1.

rates.[26] Consequently, implementating of transport system user charges could lead users to explicitly express their demands for greater efficiency in transport system management.

Road vehicle owners and operators using the roads for their economic or social activities or for personal pleasure can be considered members of the "road user club." Likewise, there are members of the "waterways user club," and some users are members of more than one of these clubs. As in all clubs, members must pay for the infrastructure they enjoy, or at least take responsibility for finding some source of financing. People who have no interest in transport would not become members of the club and should not be obligated to contribute to financing the infrastructure.

Certain *public* functions of the road transport network, however, are not directly related to the particular infrastructure use by individuals or their vehicles: transport infrastructure may be necessary for defending the country and its citizens against potential foreign enemies, and it may play a strategic role for supplying basic government services or emergency goods to the population. This may require extending the road infrastructure into all geographical areas, including those with a low population density.

These public functions should be financed by society as a whole, through general taxes, because they are considered a component of the social sectors (basic education, basic health, national security, and public administration); road infrastructure therefore, would be a part of the fair distribution of the services provided by these sectors.

Central government should play the role of "Board of Directors" of the club of transport-infrastructure users, defining the amount each "member" should pay for use of the

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[26] Conservation is focused on maintaining good infrastructure condition or quality, whereas capacity extension or quantity of infrastructure would primarily mean development or new construction.

installations, and the membership fee for its own *public* functions.

*External effects: the polluter pays.* A complicating matter is that some member groups use vehicles with greater negative external effects than those of other groups. Not only do the vehicles require infrastructure that needs to be conserved (because of the wear and tear the vehicles bring inflict on the infrastructure), but the vehicles also produce emissions (and solid waste at the end of their technical life) that endanger the natural environment and human life and health. Members of these "user club" should thus be required to pay compensation for the external damage they cause.

In order to keep the total external damage within manageable limits, the "Board of Directors" of the transport infrastructure user clubs will attempt to shift "club membership" toward the user groups that inflict the least external damage. Members of some clubs will have to pay a polluter charge in addition to user charge. Members of other groups might pay less than the user fee if they deserve a "premium for not polluting."

In sum, the objective of transport pricing adjustments is to attain a situation in which:

- actual prices more or less reflect economic prices (including environmental costs), or at least show no large differences between the various modes of transport with regard to the proportion of rates or tariffs to economic costs.
- users of the transport modes pay the financial costs of transport, including the costs of maintenance and construction of infrastructural works.
- the transport sector as a whole covers its own costs.

It is doubtful whether all three conditions are fulfilled in many countries. Transport subsidies are exceptionally difficult to abolish because of the financial interests created and

particularly because the structure and location of production and consumption may have been adapted to a subsidized tariff system (see physical planning and urban remodeling).

*Establishing size of sustainable transport networks by mode*

In countries that have great difficulties in conserving or maintaining their existing transport networks, a necessary first step is to determine the revenue collected from the users of the networks (road, rail, inland waterways) and the expenditure necessary for appropriate conservation measures. In countries where ample revenue is collected from the transport sector but where the funds are not spent on maintenance, the question is: where do the funds go? Are they spend 'elsewhere' in the transport sector, for example, for funding overambitious network extensions or for subsidizing loss-making public transport services? Or are they used in other sectors?[27]

**Table 4b. Sustainable transport networks: Establishing network size by mode**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Establishing size of sustainable transport networks by mode | Use-base and willingness to pay, classified networks, unit conservation costs | Transport planning, survey tools and results |

If the user revenues for a sub-sector (such as roads) or for the transport sector as a whole are not sufficient for network conservation, it will be necessary to consider the reduction of one or more of the "modal" networks. The central government must be able to guarantee its users that the publicly agreed trunk networks will be conserved such that a certain minimum level of service is always maintained. This implies, for example, that

[27] A "public expenditure review" of the government budget and detailed national accounts will help to clarify this issue.

- the trunk-road-network will interconnect specified centers at a certain, consistent "trip-quality" standard (travel time and speed, axle load, and safety).
- selected railway trunk routes will be able to carry a specific wagon axle load at a specific stable quality standard (travel time and speed, and safety); and the railway trunk network will be operated with a choice of passenger services (high speed and comfort at higher costs and low-cost services at warranted minimum quality and reliability).
- selected waterway trunk routes will be able to carry at least a certain vessel class at a stable quality standard (least available depth, navigation time and speed, and safety).

*Railways*. The following range of measures may be considered in addressing the financial deficits of railways.

- discontinuation of the most unprofitable transport services, such as 'mixed cargo' services.
- concentration of efforts on long-distance, large-volume goods transport flows (such as unit or block trains).
- increase of unit freight rates up to full financial cost levels.
- differentiation in passenger train services with increases in tariffs up to full financial costs for all luxury services and a readjustment of the "free passes" and fare-reduction system.
- gradual increase (in real terms) for the rates of low-income passenger services.

If these measures turn out to be insufficient, selected branchlines should be shut

down. It may take five to ten years (or even more) of "turn-around" management to gradually implement such a series of measures, which implies that the railway sub-sector would continue to face considerable deficits—to be recovered from elsewhere within the transport sector.

A useful tool in a railway restructuring process may be the *performance agreement*, a formal protocol between the government (usually the owner of the railways) and the management of the railways (a public enterprise running the services). Intentions, obligations, and responsibilities of the two parties, including performance levels expected from the enterprise, are set out in the protocol, which is generally negotiated for a three to five year period.

*Road networks*. Though international comparison is difficult, a first indication of the sustainability of paved road network length can be obtained from the following three indicators:

- *kilometers of paved road per millions population* (734 for China and 1494 for Brazil which have similar GNP per capita).
- *kilometers of paved road per billions US$ GDP* (299 for China and 305 for Brazil and 408 for Spain and 619 for The Netherlands).[28]
- *motorized vehicles per kilometers of paved road* (___ for China and 69 for Brazil).[29]

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[28] For thinly populated Surinam it is 907, indicating that there is much paved road to be conserved for each US$ of national income (the network is clearly beyond proper conservation).

[29] Surinam, with 29 motor vehicles per kilometer, has relatively few motor vehicles to pay for the road infrastructure.

If both the first and second indicator are relatively high, but the third is relatively low, the road infrastructure costs are likely to be allocated to relatively few users (private cars, goods vehicles and trucks, buses, motorcycles and mopeds).

In the total classified road network, several different road administrators may be responsible for primary (trunk), secondary, and tertiary (minor or rural access) roads respectively. Moreover, there may be a wide range of paved and unpaved roads, varying in geometric and construction standards from structurally sustainable to marginal. Coordination, if not re-organisation, among the various road administrators may be urgently required to achieve a network that the users perceive as "comprehensable." The same can be said about the practice (or absence) of regular road inspections, up-to-date road inventories, and periodic surveys on roads traffic.

A system of geometric[30] and structural[31] standards is a primary necessity, if it does not exist, along with an associated set of realistic (re-)construction and annual maintenance costs per kilometer of *typical* road types (unit costs data to be kept up-to-date).

Countries with numerous waterways require many river-crossings in their road and rail networks. Bridges (sub-divided into bridges larger than 50 meters total length, and smaller bridges) and ferries add considerably to the cost of operations and maintenance (and are expensive to replace).

From this basic data and information—prerequisites for any road network reform

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[30] For example, reduced width in order to reduce future maintenance; effects of climate (rains) on unpaved roads, shoulders, longitudinal drainage.

[31] For example, no (re-)paving without proper attention to the total road and foundation structure; scheduled application of asphalt overlays if the road design was based on this principle; maximum axle-load control (checks on imports of heavy trucks and specifications).

process—the next logical step is a "a new approach for road network management and conservation," such as the one described in the 1993 United Nations Economic Commission on Latin America and the Caribbean book *ROADS*.

*Inland water transport.* Inland waterways are an important asset for countries with water resource systems. Though rivers are often considered "a gift of nature," providing a transport infrastructure free of charge, the practice of modern, large scale inland water transport in a competitive transport environment (with rail and road transport) calls for well-developed planning and management skills[32]. There is certainly scope for the as yet unexploited advantages of inland water transport as a low-energy consuming, environment-friendly and a cost-effective means of freight transport of long-distance, bulk cargoes; however, this must be based on thorough market research.

On the one hand, there must be adequate demand within the range of competitiveness of inland water transport, preferably already in congested rail and road corridors, or in the long-term when locations of goods production and consumption can be strategically planned to optimize the comparative advantages of inland water transport (see section on land-use planning and choice of economic activity location). On the other hand, rivers may serve many purposes other than navigation, such as irrigation, hydro-power generation, fisheries, supply of drinking water and industrial process water, drainage, waste evacuation, and as a source of sand and gravel excavation, so that there may be conflicting interests to be

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[32] However, to turn the river into a fairway which can accommodate modern craft may altogether be a costly affair.

settled.[33]

*International seaports*. The strategic position of international seaports and airports requires their linkage to the national (and sometimes international) trunk routes; direct access to the major port areas from the (inter)national network of principal routes can bring significant economic benefits (hinterland effects).[34] Long-term forward planning for major port extensions (land reservation or seaward extension and land reclamation) in conjunction with—or within the context of—a Transport Structure Plan is desirable[35].

*Introducing a transport infrastructure fund*

A transport infrastructure fund will provide a better framework for integrated transport policy. A fund-based system will ensure greater continuity in infrastructural finance.

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[33] Countries with substantial water resource systems used for multiple purposes should consider preparing a "structure plan for water resources", which would have a close link with a Transport Structure Plan as far as Inland Water Transport is concerned.

[34] For example, where they are serving land-locked neighboring countries; in that case, foreign users of the national transport network should also be required to pay the transport proper rates or tariffs.

[35] For a country like India, it would be quite appropriate to prepare—at the central government level—a "structure plan for seaports," which would be closely related to the Transport Structure Plan at the national level (see first section of this paper).

*Transport infrastructure conservation.* Infrastructure conservation necessitates long-term guaranteed and stable financing rather than annual allocations from the general government budget. There is no rationale in reconsidering and discussing financing for infrastructure conservation every year; adequate infrastructure conservation is implicitly committed in the earlier political decision to build the infrastructure. Of course, it will be necessary occasionally to reconsider and discuss the *sustainable networks* in terms of their continued functional use and the amount users are prepared to pay (see previous section). This trade-off should provide the grounds for decisions not to conserve certain infrastructure links if the user charges fall short of the conservation needs.

**Table 4c. Sustainable transport networks: A transport infrastructure fund**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Introduction of transport infrastructure fund | Passing of concerned legislation | Deadline met |

The part of the infrastructure fund devoted to conservation will be fed by user charges, and its needs can be determined once the network length and classification and the realistic unit costs of maintenance are established. Some of the network may be in such bad condition that it needs rehabilitation even before routine and periodic maintenance; support for this rehabilitation could come either from within or from outside the conservation part of the fund.

The distribution or allocation mechanism of a fund is required to give each mode of transport its fair share of the conservation fund and—particularly for roads—to provide local governments with their share for fulfilling their road administrators' responsibilities for road

conservation; the former provision will be easier than the latter.[36] Moreover, it may be necessary to attach a monitoring instrument for "engineering and finance authority" to the conservation fund to ensure that the recipients actually spend the funds on infrastructure conservation.

*Construction of new transport infrastructure*. The central government must fund more than just the conservation of the trunk networks, though it should refrain from purchasing and operating vehicles, trains, vessels, and aircraft. Construction of new transport infrastructure links, extending the networks that are to be conserved, and increasing the capacity of already existing network links (which will also add to the conservation tasks) constitute important capital investment elements and decisions of the government, particularly in a rapidly growing economy.

One obvious way of dealing with the capital investment requirements, providing the extra infrastructure for future users, is to raise the funds by loans (or by floating of bonds or both). This implies that the interest and amortization must be paid in the future by the users. Moreover, if previous infrastructure investments have been financed through loans and interest and amortization still must be paid, this debt service should also be covered by user charges. A development part of the fund thus would be fed by loans (to finance development of new and extended transport infrastructure) and user charges (for servicing the debts). All

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[36] Given the basically established "conservable" road network length, a two-tier distribution system may be applied: (1) among national and local road administrators (local road administrators covering "Transport Regions" or districts) basically on the basis of vehicle-kilometer-performance, possibly modified with a few other criteria (population- or economic activity-related), and (2) within the local road administrators' competence on the basis of simplified selection or ranking criteria using, for instance, a Ranking Index (RI) formula of the form:

RI = k * (Road deterioration proxy-variable * Average Daily Traffic * 365)/(Rehabilitation or Maintenance Costs); k = a constant.

users of transport infrastructure, therefore, should contribute to both conservation and development. If total contribution from users is not sufficient to cover total fund expenditures, cuts should not be made to the conservation part of the fund.[37]

Supposing that the vast majority of the user charges is centrally collected, government road administrators and the railways or inland waterways administrator would receive their shares as grants from the central government.

Questions that remain unanswered include:

- How to collect the user charges for conservation and development of the various transport infrastructure—from private cyclists, motorcyclist, and car drivers, from passengers on buses, boats, and trains, and from freight transport operators on roads, railways, and inland waterways.
- On what grounds can the government make certain users contribute more—and consequently other users less—than the amount that would result if the different modes of transport (and goods and passenger transport within one mode) were considered in isolation.[38]

*Fund raising*. Fuel tax is the variable that most directly correlates with intensity or frequency of transport infrastructure use and its wear and subsequent maintenance

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[37] Rather, part of the development expenditure should be postponed. Alternatively, there may be a good reason to reduce the conservable networks somewhat, thereby decreasing conservation expenditure, and enabling a "transfer" to development expenditure; but the reasoning behind this must be "transparent."

[38] In other words, will cross-subsidization be accepted as a fundamental principle—at government's discrete use—to favor particular methods of transport; for example, punishing certain modes because of their negative environmental and other external effects, and reward others for the absence of such effects.

requirements. A fuel tax should be an obvious funding source for a transport infrastructure fund. Fuel tax on diesel also charges for rail[39] and river transport—which should also pay for their infrastructure—and the industrial sector, where a revision of energy prices might be quite appropriate anyway, albeit for other than transport reasons, notably to stimulate energy-efficiency and fuel switching, and to compensate for environmental damage.[40]

Any imbalances, distortions, or overall shortage can be detected by comparing the country's fuel tax income from the transport sector (gasoline and diesel, with a breakdown per vehicle, train, and vessel type) with the true costs of the transport infrastructure networks per mode, conservation, and development. This insight will make it possible to assess scenarios for adjusting the imbalances or for discerning the amount of additional funds that need to be raised, or both. This assessment cannot, however, be made without considering another important funding source, the road tax (or the fairway tax for inland water transport), discussed hereafter.[41]

Fuel taxes (per liter) for gasoline and diesel probably would be divided between the transport infrastructure fund and the general budget.

Apart from taxes on fuel, road users—and to some extent the other transport modes—pay a number of other taxes: import duties and sales taxes on vehicles and spare parts (rolling stock and vessels) and tires; and road tax, licence fees, registration fees, and so

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[39] If railways are predominantly electrified, it may get somewhat more complicated, depending on the ways the power is generated, but the principle, fuel-related tax remains the same. See also next footnote.

[40] This underlines the relation of a Transport Structure Plan with an Energy Structure Plan, presenting the principles of the national, integrated (long-term) energy policy.

[41] If railways operations were privatized (and, for example, more railway operators would be allowed on the same railway infrastructure), there might also be a railway tax charged to the operator(s).

forth.[42] The revenues from import duties and from sales taxes are part of the general budget; understandably, they are not specifically levied for transport purposes and cannot be "claimed" by the transport sector. It is also reasonable that licence and registration fees are used primarily for covering administration costs rather than as a source of income for a transport infrastructure fund.

The road tax, therefore, is the only logical source for a transport infrastructure fund, at least as far as funding for roads is concerned. The road tax provides the opportunity to properly account for the fact that most wear of or damage to the roads is caused by trucks that is, vehicles with heavy axle loads measured in terms of Equivalent Standard Axle loads, who should pay for proportionally larger share of the variable maintenance costs.[43] The conclusion might be that additional annual charges on the road tax for specific (heavy) vehicles would be appropriate.

Similarly, the inland water transport sector may contribute a fairway tax, and the railways a railway tax. Other Fund income may be generated from tolls (toll road sections or toll bridges and tunnels, owned and operated by the government) or from new sources, such as a peak-hour surcharges on road tax or selling of assets.

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[42] Relatively small amounts may have to be paid as tolls on some roads and river crossings.

[43] Road maintenance costs can be sub-divided into a *fixed* and a *variable* part. The variable part is correlated with the use made of the road. The wear of the road largely depends on the (Equivalent Standard) axle loads. Distribution or allocation of the variable maintenance cost (over vehicle types) should then be in proportion to axle load, therefore on the basis of Equivalent Standard Axle-kilometers. The fixed part of the maintenance costs should be distributed on the basis of vehicle-kilometres. According to international experience about 25 percent of road maintenance costs are variable, but this figure may differ from country to country and needs local verification. Annex D presents a simplified example of a single-mode funding mechanism.

*Private sector participation.* An ambitious scheme in a rapidly growing economy may be to superpose a national toll road system. Would the central government consider this a long-term option worthwhile pursuing within the Transportation Structure Plan? A privatized toll road system would be fully self-financing and would likely generate additional income for the government to compensate for external environmental costs. The possibility of private participation will depend on the government's ability or interest in funding such new and innovative transport projects. There may be other *build, operate and transfer* opportunities for private sector participation, particularly on the urban transport scene (such as commercial exploitation of land or air space at transferia), which could relieve the government funding task.

*Financing (part of) urban transport infrastructure.* Roads in urban areas should be conserved or maintained from part of the proceeds from urban land- or property tax or both.[44]

Municipal *land development for city expansion* is an interesting option for raising municipal funds, particularly in a rapidly growing economy. A prerequisite is that local government ex-propriates *undeveloped* lands, such as agricultural- or wastelands, at prices determined by court-rule. These relatively low prices are free from speculation reflects the economic value of the land in its original use. Next, the local government undertakes to develop the area (for example, by contracting out the work), including the necessary infrastructure (such as roads or cyclepaths) and implied infrastructure-extension needed

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[44] The same principle should in fact be applied for most of the tertiary rural roads and roads in rural residential areas (a user charge in the form of land or property tax).

elsewhere in the city, and it sells or leases the land to interested parties at cost-recovering prices. The ingredients for success are adequate organization and management, democratic and socially acceptable pricing and decisionmaking, and prevention of excessive land-speculation.[45] A high GNP per capita is not a necessary pre-condition.

*Other appeals on Central Government funding*. In cases when public transport operators are requested by government to keep non-economic lines and services operational (for political, regional-economic, or social reasons), the government should also pay the bill.[46] In many cases, government departments other than the Ministry of Transport should be made responsible, according to the principle that those who make the decisions bear the consequences. If, however, such subsidies would have to be paid from a Transport Infrastructure Fund, it seems appropriate that the fuel tax income split between the Fund and the General Budget is adjusted accordingly.

Other cost categories, mainly related to road transport, include the cost of transport and traffic regulation *enforcement machinery* (traffic police, and so on) and costs related to traffic accidents (not covered by the insurance circuit). They are largely a function of traffic volumes (vehicle-kilometers) but normally are paid from the general budget and therefore are implicitly related to the fuel tax income share of the general budget.

Particularly if institutional and legal reform is a prerequisite for rehabilitation and development of the transport sector, the costs of project preparation, coordination and management will be considerable, at the level of both central and local government (for

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[45] This will require a fair amount of institutional and legal reform (see section on institutional reform).

[46] This should be formally arranged in a "Performance Agreement" between the public transport enterprise and the government, determing out the level of service expected and the compensation given in return.

example, a transport region planning framework). The central government should develop grant schemes for these *process costs* to be paid from the fund.

*Legislation.* Drafting a law to establish a transport infrastructure fund is the responsibility of the transport minister. The Minister should send the legislature memorandum outlining the structure and substance of a proposed Fund well before the bill is submitted for approval.[47]

*Accessibility*

Accessibility is the equivalent of *mobility opportunity*: an individual's access to transport modes with respect to economic and physical ability to engage in non-home based activities; by contrast, *mobility* is usually defined as the average number of daily trips per person (sometimes the number of kilometers travelled).[48] Similarly, the usual measure for mobility of goods is ton-kilometers, though the essence is mobility opportunity: the ability to move goods from locations where they originate to locations where they are required.

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[47] A memorandum would, for example, test the option of a transport bank as the executing agency of the fund.

[48] L.D. Burns [Burns, L.D, Transportation, Temporal and Spatial Components of Accessibility, Lexington, Massachusetts: Lexington Books 1979] defines mobility opportunity as "a measure of people's freedom to take part in various activities (work, shopping, etc.).

The more traditional 'topological' measurements take into account only the transport or communications network in the reference zone, for example *grid density*, using an index for each zone, for instance:

$$D = (1.5*A + B + 0.4*C)/S, \text{ where:}$$

A = kilometers of (paved) road six meters or wider, in good (surface) condition,
B = kilometers of (paved) road four to six meters wide and in good condition,
C = kilometers of unpaved (earth or gravel) road four meters or wider,
S = area of reference zone in square kilometers.

*Mobility limited*, the opposite of *mobility opportunity*, implies a mismatch between personal travel needs—or the necessity to move goods—and available means of transportation. Mobility limited is the problem to be addressed from the user's perspective.

*Market segmentation*. Transport demand is commonly sub-divided into the following user characteristics:

- income: low, medium, high
- age: child, economically active adult, elderly
- gender: male, female
- occupation: pupil or student, government employee, private or informal sector;
- experience: no bicycle or car driving experience, experienced or licensed rider or driver
- type: transport of people, transport of goods
- trip purpose: work trips, school trips, personal or social visits.

A large proportion of the population in developing countries has virtually no access to motorized transport because they cannot afford it: the market is segmented according to income. What, then, is *transport user profile* of the low-income groups? "Doomed" to walk forever? A bus trip now and then? Able to afford a bicycle at a certain income level?

Market segmentation should be clarified and "average" user profiles may be quite helpful. For example, *the "average" urban cyclist is a 30-year old male with a monthly net income of US $90 (well above the prevailing minimum wage level of US $60) who uses his bicycle mainly for work-related purposes*. How many of those cyclists do we have in our

city or region? What are we doing for them in terms of facilities? What are the costs and benefits in economic, social, and environmental terms?

*Rethinking mobility*

Transport and manifestation of mobility in OECD countries is a consequence, not a prerequisite, of economic prosperity and mass purchasing power.[49] OECD countries with serious greenhouse emissions problems and other negative impacts of the transport sector as stressed in UNCED's Agenda 21, should start at home in setting the pace for worldwide structural changes.

**Table 5a. Accessibility: Rethinking mobility**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Rethinking mobility | OECD countries Transport Structure Plan<br>Values and norms | Example-setting; eloboration by industrialized countries of their signed commitment to *Agenda 21* in quantitative terms (energy and transport) |

*Lifestyle and transport*. Passenger car kilometrage (or mileage) has increased about sixfold during the past thirty years for a nearly constant number of everyday's trips; commuting and shopping by car have become an intrinsic part of the western and northern

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[49] Work by J.L. Madre & T. Lambert ((Prévisions a long terme du trafic automobile, Collection of Reports by the CREDOC, Paris, 1989) indicates that rising *auto*mobility (= private car mobility) is essentially prompted by economic growth. Elasticity of national road/motorway car traffic in relation to:

*real mean household income* = + 0.45.

motor fuel prices = - 0.21 @ - 0.23
total length of motorways = + 0.15 @ 0.21
size of car population = + 0.57 @ 0.65

lifestyle. The vicious circle of growth in number of automobiles and consequent use[50] of motorcars consists of ever-growing demand for roads and parking space, which erodes the basic characteristics of the urban environment (besides the noise and exhaust fumes) and leads to an even greater exodus of urban inhabitants to greener pastures.

To whom does the city belong? (The commuters?) Who benefits from the city? (The developers and their clientele?) For whom are the city councils planning? (Those who contribute to its destruction?) And is it truly inconceivable to control the intercity competitions in this respect? Or are the benefits and planning meant only for those who are actually living in the city? There are many questions, but as yet no answers, except maybe in a few, precedent cases. Sustainable planning strategies and broader public participation in setting objectives for and in decisionmaking on planning processes would be enormously assisted by rising prices for the consumption or destruction of valued urban assets. If the question of lifestyle and transport in modern industrial or industrializing countries is beyond any fruitful, rational discussion, changes in spatial and land use planning and transport and the use of the best affordable techniques might still be achieved through the principle of full cost pricing and supplementary regulations.

*Pricing policy*. Travelers hardly notice the vast differences in damage to the environment, because these do not show up in the costs of travel. In the daily choice (of higher-income travelers) between the car and the train, the car invariably appears cheaper.

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[50] Data from UK's National Travel Survey 1985-86 indicate the following developments in travel distance per week (in miles) by car ownership over a 20-year period:

| | People in Households with | | |
|---|---|---|---|
| | No cars | One car | Two or more cars |
| 1965 | 42.0 (59 percent) | 96.0 (36 percent) | 132.0 (5 percent) |
| 1985/86 | 40.6 (38 percent) | 104.4 (45 percent) | 162.7 (17 percent) |

Reducing the environmental damage of cars, by significantly reducing air pollution, fossil-fuel consumption, carbon dioxide emissions, and noise nuisance and by improving road safety will cost a great deal. Forcing car owners and users to pay for the increased costs—in other words, *internalizing* these costs—will influence travel behavior and choice of travel mode.

Currently the main problem lies in making the consumers aware of the damage created by their behavior, and thereby having them accept the required price increases of automobility. Consumers might change their behavior as soon as they become aware of the damage, but unfortunately this will not happen without the higher prices.

The actual mix of concrete measures of raising fixed or variable costs may vary from country to country, depending on the situation and the field of political forces. Increases in variable costs would include higher automobile purchasing costs due to strict specifications, higher licence fees and road tax caused in part by proper enforcement of regulations, and higher fuel prices with or without fuel switches.

The dilemma for transport ministers, who have an increasingly unenviable role, reflects double standards in society: everyone wants to travel more without being bothered by other people doing the same, and everyone wants a better environment and more mobility. Within the context of commitments made in international fora such as UNCED (Agenda 21), setting examples in this area may have positive effects. Wealthy countries and their transport industries (car and truck manufacturers and fuel producers) need to demonstrate in their target-setting Transport Structure Plans that they are indeed prepared to tackle at the roots the environmental and social problems created by the transport sector. And developing

countries may then follow suit.

*Physical planning and urban remodeling*

Many land-use issues in industrial countries are concerned mainly with the quality of urban life, while those in cities in developing countries are often questions of life and death. But all cities, whether surrounded by affluent suburbs or makeshift shantytowns, now need to plan land use far more carefully to avoid chaos and catastrophes. Western Europe has a long tradition of actively controlling land use so that the often small amount of available space serves the public interest more than that of private developers.[51]

**Table 5b. Accessibility: Physical planning and urban remodeling**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Physical planning and urban remodeling | Land-use planning debate involving the public and neighborhoods,<br>Growth rate of secondary urban areas,<br>Modal share of various transport modes,<br>Legal establishment of formal land-use plan. | Technical assistance from the government,<br>Relative increase exceeding that of megacity in country,<br>Percentage of change in favor of non-motorized modes,<br>Deadlines met. |

Developing countries have the loosest controls over urban development. Particularly in mega-cities (such as Shanghai or Sao Paulo) skilled land-use planning is badly needed but seriously constrained by the fact that most of the physical growth takes place in illegal, unplanned squatter settlements, rendering useless even the few existing planning mechanisms.

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[51] Lowe, Marcia D., "Alternatives to Sprawl—Shaping Tomorrow's Cities," *The Futurist*, July-August 1992.

These *illegal* communities may hold 30 to 60 percent of the population in these cities.

Land use plays a greater role in defining the city's transport system than any traffic planner or engineer. A city's transport system functions better if things are closer to home. By failing to see land-use planning as a transportation strategy, many of the world's cities have allowed the automobile to shape them. The automobile has segregated homes from jobs, shops, and other centers of activity, long after the period when public health protection against threats from industries called for this. This practice of compartmental zoning, formalized in legislation and disseminated in academic schools of thought, unfortunately has been imported by many developing countries.

Throughout Asia, Latin America, and Africa zoning that isolates activities burdens public transport by creating distances too long for a walk or bicycle ride. As a result, many vital services are out of reach for the vast majority of citizens.

It is not too late even for well-established cities to improve their land-use pattern. Dispersed areas can be made more compact by filling in underused space including redistribution of urban landownership, and strategic city space may be claimed back from the automobile.[52]

Nearly every urban area has two faces, one with good housing and connected to a variety of services and amenities, and the other ill-housed and excluded from many such opportunities. Often the disadvantaged are geographically isolated, and their existence is more or less ignored by government authorities; they often lack the political power to achieve improvement of their neighborhoods.

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[52] Even in cities such as Bogota, Colombia, where most areas are overcrowded, a surprising amount of land in other parts is vacant or underused.

One of the most important planning tools for a more humane city is a planning process that involves the public. Neighborhood organizations need to come together and 'wrest' liaison with the city administration and planning council. Priority should be given to providing technical assistance to neighborhood groups to facilitate their participation in the urban planning process.

In sum, to achieve *compact* growth of cities three main conditions must be met:

- the public (neighborhoods) and decisionmakers need better access to information about the characteristics of a community's population and the probable consequences of various planning decisions,
- cities and surrounding areas need a greater degree of regional cooperation to prevent land use in one jurisdiction from producing problems in others,[53]
- urban areas need stronger support from their national government, giving them greater budgetary power to plan their own long-term development strategy.

In many developing countries where the consolidation of population, power, and wealth in the capital and other megacities is extreme, national funding support is crucial for helping secondary urban areas attract some of the urban development now concentrated in the big cities.

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[53] See section on transport region concept.

*Urban transport*

Innovative *indigenous* ways of addressing increasing incompatibilities in urban development are urgently required, notably concerning the following issues:

- growth of mobility needs, essential for efficient internal markets,
- costs of transport, in particular affordable transport for a majority of the population,
- availability of sufficient transport capacity,
- efficiency or productivity of the urban economy,
- land-use development with rapidly increasing intracity distances.

**Table 5c. Accessibility: Urban transport**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Urban transport[54] | Local land-use plan,<br>Non-motorized facilities,<br>Collective public transport service level,<br>Parking spaces,<br>Private car occupancy. | Integration with transport system,<br>Network development,<br>Network coverage,<br>Connection with non-motorized transport,<br>Control and pricing,<br>Targeted increase. |

Motorization is gathering momentum in many Asian and Latin American cities, with the motorbike as the fastest growing mode of transport. It is important to find practical and realistic solutions, given the financial and technical possibilities and limitations in urban transportation, and to consider all options carefully and select the best possible mix. It is rather unlikely that a single transport option would provide the answer. However, more

[54] See Annex B for a listing of key elements of an urban transport system and sectors, needs, constraints, and alterables according to F.C. Kohli (Tata Consultancy Services, Bombay, India). Ref. his address at the International Seminar on "Sustainable Transportation Strategies and Development," June 1992, Rio de Janerio, Brazil.

important than the "answer" to the transport questions raised is *who* provides the answers?

In other words what are the *national and local platforms*? What is the policy level involvement and commitment of the local and the national governments? How involved are the users and is there any encouragement and acceptance of users' experience? To what degree are professional research groups involved and do they influence innovative and independent thinking?

Given a nucleus of national and local platforms with the political, financial, and administrative capability to plan with a long-term view, it is important to ensure that decisions made today will not prove inconsistent with long-term goals.

Redistribution of urban traffic spaces, mostly by traffic management, and selective capacity-extension, both based on a marketing approach and a review of alternative options ("how to find compromises to serve all transport users?"), are the logical first steps. The most important transport supply options that provide an alternative for individual automobility are collective public transport (buses and mass-transit), and individual non-motorized transport, with special consideration for freight transport, an essential engine of the urban economy.

*Bus transport*. Integration of public transport, roads and land use is feasible for a city population of over one-and-a-half million, developed over a 20-year period (the time horizon of a Transport Structure Plan), as the case of Curitiba (Brazil) demonstrates.[55] The reasons for the success are the cities' *land-use policies*, based on type and density of use, and the

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[55] "Transport and the Environment" *Industry and Environment* (United Nations Environmental Programme, IE/PAC) 16 No. 1-2, January-June 1993.

designation of a *hierarchical bus system* involving exclusive express busways along linear *growth axes* and circular interdistrict bus routes. The use of express buses on exclusive busways is far cheaper than the use of subways or light railways and is much more practical and affordable for medium-sized cities.

Brazil's political leadership has strongly and consistently advocated the integrated long term policy, and management of the Curitiba Public Transport System has been kept separate from operations. The bus system is operated by private companies that receive permits for specific routes and have to abide by regulations developed and monitored by the Curitiba Public Transport System-management. Total revenue collected by each bus is immediately deposited in a bank account managed by a kind of transport region authority. The companies receive their revenue ten days later based on their *bus-kilometers* performance. Management monitors the number of passengers, based on daily readings of sealed turnstiles, and the number of kilometers including verification of the performance of different routes, tacho-graph readings, on-off surveys, and 24-hour supervision of bus garage doors. All this clearly illustrates the overriding importance of a well-functioning *institutional and legal environment*.

In most current situations of bus transport, the following issues need to be addressed:

- *Regulation and deregulation*. Both bad regulation and bad deregulation should be avoided.[56] Bad regulation, such as keeping fares at an artificially low level, discourages investment in fleet expansion and renewal, and may eventually bring in unauthorized

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[56] ECLAC, "The impacts of subsidies, regulation, and different forms of ownership on the service quality and operational efficiency of urban bus systems in Latin America," United Nations Economic Commission on Latin America and the Caribbean (ECLAC) August 1992.

operators charging low-income citizens high fares for travel that is usually unreliable, often unsafe, and always uncomfortable. Badly conceived deregulation causes high fares, excessive supply expansion, congestion created by buses and other public transport vehicles of undesirably small carrying capacity, and—in the end—desperate attempts to turn things back.

Competition is not undesirable, but basic ingredients of regulation should be maintained; one option would be for licenses to operate specific routes be put up for bid every few years. The required service level (routes, frequencies, operating hours, size of buses, and so on) would be specified in the tender documents, and the operator offering to charge the lowest fares would be selected. The implementation of the services would be supervised. Good regulation requires an adequate supply of good inspectors. There is no point in drawing up regulations if their enforcement cannot be guaranteed. Good regulation also requires good route-planning procedures (for example, a mathematically based, computerized simulation models of the urban bus market for assessing and optimizing alternative concessions and route structures, frequencies, and so on). Good regulation also requires sensible fare-setting choosing from and combining a spectrum of options, from high fares, low occupancy, dense network, and frequent service at the upper end, to low fares and infrequent services provided by crowded buses operating on main streets at the lower end of the spectrum. Deregulation must recognize the difficulty consumers experience in obtaining adequate information about the alternatives available to them and the external effects, especially congestion and pollution. The information problem is particularly difficult to solve. External costs can be internalized via urban road pricing, provided that higher-income private

car users are also priced.

- *Organizational structures for private-sector bus companies.* Route associations, groups of individual bus owners who get together to operate one or more routes, can be quite functional. If not too loosely integrated, route associations supply bus services where demand exists and are efficient in terms of staff and bus-kilometers per bus; they encourage small entrepreneurship and are dynamic and flexible. But if the route associations are loosely integrated, individual owners tend to get too much power, resulting in inefficiencies (too many services running when demand is low because each owner anticipates that fare revenue will exceed estimated costs; higher-than-necessary investment costs per bus; higher-than-necessary maintenance costs per bus) and conflicts (such as difficulties in relations and negotiations with the regulatory authorities).

A workable scheme may be to treat a bus as a share in a bus operating company (an owner-operators association), where the company manages the bus fleet in a coordinated matter on behalf of its members[57]. Individual owners will closely monitor the treatment of their bus for example that it receives its fair share of peak period frequency, that it is not laid up for excessive periods of maintenance, and that scheduled intervals are maintained between all buses.

*To subsidize or not to subsidize.* Developing countries have skewed income distribution among their citizens; a significant percentage of urban families cannot afford to pay commercial prices for the minimum amount of bus services they use. In many cities, basic trips from home to work and home to school can consume 15 percent or more of the

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[57] Ref. Buenos Aires, Brazil.

income of poorer families. The traditional approach to help these people has been to grant blanket subsidies to publicly-owned bus companies that offer basic transportation at lower user cost to users. The main problem of blanket subsidies is that they benefit everyone who gets on board, rather than just the people who need the assistance. One way around this problem is by requiring employers to give workers special allowances in addition to their wages to cover basic urban transportation needs (see section on company transport plans).[58] Such allowances are simple to register, but over time they are considered an integral part of wages; moreover, they may not be spent as originally intended. In addition, they fail to benefit the unemployed or people engaged in the informal sector.

An alternative scheme involves the distribution of transport vouchers by employers to low-income workers.[59] Financed in part by the employers themselves and in part by the government through tax rebates, this voucher system is complicated to administer and does not benefit workers in the informal sector.

Government bodies ordering *concessionary fares* for schoolchildren and retired people at lower-than-standard fares, or for policemen, military personnel, and postmen free of charge, should compensate the bus company for the losses it directly incurs. This could be done, for example, by granting schoolchildren a pass to travel on specific bus lines, the cost of which can be reimbursed (by the ministry of education) without complicated calculations or administrative procedures. If the government wants retired people and other special categories to travel free, it could distribute all-line passes and compensate all bus companies

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[58] Colombia and Ecuador, for example.

[59] Brazil, for example.

at the same rate per seat-kilometer offered.

- *Fare control.* Any market that provides operators with a degree of monopolistic privileges (such as markets for water or electricity supply, telephone services, and urban bus transportation) is obligated to check the prices charged so that operators cannot exploit these privileges for their own benefit. Even if supply is not controlled (where there is deregulation), checking fares will prevent abnormally high fares, unusually large bus fleets, and correspondingly low occupancy.

Bus operators will begin to distrust fare-setting authorities that use political rather than techno-economic criteria, and they will react by giving these authorities false information overestimating costs and underestimating ridership. In turn, this gives the authorities excuses not to grant even reasonable increases in an environment often compounded by high inflation rates. Formulas should be devised and applied by non-political bodies, in order to enable a more transparent political debate (see section on transport region concept).[60] If fares are low, operators can only cover costs by carrying large numbers of passengers per bus, which means overcrowded conditions and infrequent service. Fares and service quality thus are directly related. Concerned authorities should be aware that they have a choice within a continuum of fare and quality standards. Where customer income levels are low and public funds to finance subsidies are insufficient, low fares and low qualtiy may be the only option, though this could be difficult politically. In higher-income areas, people are probably prepared to pay cost-covering fares for good service. Charging flat bus fares on all routes throughout a city, usually at all times of the

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[60] Removing fare-setting from the political arena is not particularly realistic.

day, has a series of disadvantages: flat rates imply cross-subsidization, they discourage operators from servicing long routes or routes with low passenger turnover, they become increasingly unattractive as cities grow, and they complicate integration with other forms of transport. The advantages of avoiding the difficulties of inspection and of the one-man operation may be overridden by in the future by technologically-advanced ticketing systems involving electronic cards.[61]

- *What to do about publicly owned bus enterprises.* Many national and local governments of various political inclinations, have reached (or seem to be in the process of reaching) the conclusion that public provision of urban bus services should cease. One way to terminate a publicly-owned bus company is to transfer the buses to workers instead of severance payments. Employees are thereby transformed into small-scale entrepreneurs and an inefficient, large public bus company becomes an embryonic model for a route association. This all supposes, of course, that the operational environment is properly adjusted at the same time.

- *Illegal operators and freedom of entry into the sector.* Illegal operators usually fulfill a need, which is a sufficient argument to tolerate their existence, albeit in a legalized manner. They should be required to comply with the same laws and regulations applied to other authorized operators.

- *An array of bus services to reflect consumer demand.* The highly skewed income

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[61] Experiments going on in Argentina and Chile. Also, reference may be made to the Netherlands system (non-electronic as yet) of the so-called national strip cards, valid for all public transport in conurbations, where the number of strips charged for a trip is roughly a function of distance traveled: a minimum fare of two strips for travel within any zone, and one additional strip charged for traveling to the next (neighboring) zone (that is crossing one zone border), and so on (for example, five strips when crossing three zone borders). Such a system suits the transport region concept.

distribution in most cities in developing countries, and particularly among bus users, necessitates a range of public transport services: different service categories with different fares. This is done to provide services for all tastes and budgets and at the same time to provide financial incentives for bus owners to replace old vehicles that have lowers fares than old buses.

*Non-motorized transport.*[62] In most developing countries, non-motorized transport has received little attention as yet in urban transport policy, mainly because of misperceptions (strong negative attitudes toward walking and cycling among middle- and high-income groups) and, as a consequence, mistaken priorities among decisionmakers. Most public policy statements present motorized transport as the sole means of travel, whereas pedestrians and (in many Asian countries) cyclists constitute the bulk of urban traffic. The latter are the most frequent traffic accident victims.

In low-income areas, including unplanned settlements, the majority of the residents use the pedestrian mode as their primary means of travel for essential trips to work or school. A large proportion of those pedestrian trips entail distances of more than three kilometers (one-way), and many of up to ten kilometers. Some workers may ride a public bus in one out of three commuting trips (thanks to a limited transport allowance) and will walk the rest of the time (or travel one-third of the distance by bus and walk the rest). Fare for school pupils may be relatively low (government imposed fares, for example, 10 percent of normal fares), but bus attendants may scare students away in favor of customers paying

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[62] Unfortunately, the name "non-motorized transport" presents a rathr negative picture of a form of transport that lacks something: a motor. Cleve marketing would call for a positive alternative name (perhaps a good idea would be national contests for best names with the World Bank offering prizes).

full-fare, so that the students prefer a long walk rather to being harassed.

Cycling in some motorized cities has become a ticket to death on the road, sharply reducing the numbers of bicycles used over the last 10 to 15 year. Pedestrian routes are non-existent, uncomfortable, or unsafe (particularly at night, and more risky for women). The lack of appropriate infrastructure for pedestrians and cyclists reflects the attitude of the policymakers. They seem not at all impressed by the relatively low cost of pedestrian and cycle paths (10 percent of the cost of a two-lane road for motorcars), nor by the foreign exchange savings on importing motor vehicles, spares, and fuel.

Cart operators struggling for a small share on the urban freight transport market (hauling food and vegetables, building materials, office stationary, household garbage, and so forth) are also exposed to reckless bus and truck drivers.

The main factors reducing the attractiveness of walking, cycling, and the use of carts in cities are: traffic safety; security at night; lack of pedestrians paths and sufficiently direct and shaded tracks; absence of cyclist facilities (tracks, traffic management, bicycle parking); and non-affordability of bicycles for a significant proportion of the urban population. The role of non-motorized transport should be addressed from the *costs and benefits* perspective. At the individual end-user level, the following questions need to be answered about the role of non-motorized transport:

- When, why (or why not), and for whom is non-motorized transport a desirable option?
- Is non-motorized transport affordable?
- Is non-motoroized transport available?

Answers to these questions call for a typical market research approach, which is rarely practiced in traditional urban transport planning.[63] At the aggregate (macro) policy level, the following questions arise:

- What is the macro-economic impact of non-motorized transport compared to that of motorized transport?
- What contribution can urban mobility with non-motorized transport make to urban productivity and efficiency compared to the situation without non-motorized transport (non-motorized transport marginalized if not eliminated by motorized transport)?

A necessary first step in articulating *user perspectives* is to create a broad-based platform on **urban mobility and the role of non-motorized transport**. This should include focused group discussions with market parties (users, suppliers, and stakeholders) to clarify the cause-effect relationships in urban transport and existing conflicts of interest between various groups, as well as analyses of existing data and observations to map out urban mobility and accessibility and transport-economic factors such as cost and affordability, and economic impact of a lack of transport.[64]

*Mass-transit facilities*. In terms of energy consumption and pollutants per passenger-kilometer traveled, well-planned and well-used urban rail systems can serve large masses of

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[63] Even in China and India, the level of attention given to the interests of non-motorized transport users is not commensurate to the importance of the modes of non-motorized transport to the Chinese and Indian economies.

[64] In Shanghai (China), for example, bicycles used by both male (60 percent) and female (40 percent) commuters; average trip distance of men is somewhat longer (5.8 kilometer against 4.9 kilometer). About 24 perent of all 1986 trips used the bicycle (36 percent walking, 36 percent bus and 4 percent other). More than 25 percent of the cyclists ride longer than 30 minutes; one in three say they would accept a 60-minute travel time to work or school.

people favorably—if they can afford the fare. Hourly capacities per direction or lane of 15,000 persons for light rail transit to 50,000 persons for rapid or underground rail system are possible at relatively high urban travel speeds over larger distances.

Unit transit costs[65] of about 0.03US$ per passanger-kilometer are not high in comparison with those of private cars (0.15 to 0.30US$ per passanger-kilometer, depending on congestion), or even those of light motorcycles (scooters and mopeds: 0.04 to 0.08US$ per passanger-kilometer). They are of the same order of magnitude as those of other collective public modes of transport (various bus services, shared taxi, and cycle rickshaw), but high in relation to the unit costs of cycling (0.03 to 0.09US$ per passanager-kilometer) and, of course, walking. The daily transit trips that need to be made over longer distances of 5 to 15 kilometers as a result of the urban sprawl make the rapid transit costs high—and thus unaffordable—for low-income groups.

Light railway systems or underground metro systems require large capital investments (ranging from US$ 20 to 100 million per kilometer) and for a long-term perspective. They also must assure the massive ridership (not only one-way, and not only in peak-hours) provided by high-density corridors and central areas. The spatial inflexibility of a rail system (once the investment has been made), makes its success highly dependent on the choice and implementation of land-use planning.

Cities in developing countries can afford more or less conventional rail-based rapid transit systems only under the following conditions:

- a high transport demand in the proposed corridor(s).

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[65] Of course, one has to be very careful with unit costs, since differences between the same mode of transport operating in different places can be quite large.

- a relatively prosperous and growing urban-economy, ensuring financing of the project and patronage by the urban population.
- an expanding city center so that the system can contribute to the desired urban structure (land-use controls).
- a low-cost system (at street level rather than underground) to minimize capital outlays.
- a differentiated fare system promoting equitable ridership, yet financially sustainable through cross-subsidies.
- a stable and capable administration that can implement urban traffic management and the associated enforcement (restriction of *auto*mobility and car parking in the rapid transit market), and adequate public transport management.[66]

Any proposed system needs to be integrated with the adjusted existing public bus transport system, and with non-motorized transport, providing essential *feeder* services. Duplication of rail and bus services should be eliminated to prevent excess energy use, and pollution, and unnecessary competition.

*Freight transport*. The efficient utilization of goods is dependent upon their movement to the locations where they are required. The role of freight transport in cities has received relatively little attention in urban transport planning and surveys; there is virtually no information on the increase of industrial-economic and social costs of goods as a result of congestion, or on the share of transport in the sale prices of products. The latter

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[66] Allport, R.J. and J.M. Thomson, "Study of Mass Rapid Transport in Developing Countries," Halcrow Fox & Associates, UK, 1990.

variable, in combination with price elasticities, will largely determine the tendency of retail trade to move to less-congested locations.

A well-functioning urban goods transport system will require a direct trade-off of the interests of this sub-system against those of other transport sub-systems. Such interests are—in so far as goods are transported by the traditional motorvehicles (pickups, trucks)—clearly conflict in terms of the negative impacts on urban goods transport from measures such as:

- restraining through-traffic and thus disturbing optimal distribution routes of goods transport operators.
- parking policies that hinder legal loading and unloading of trucks, or blockage of loading and unloading bays by parked private cars.
- reserved lanes for buses or trams that reduce traffic space for other road traffic, and cycle routes (particularly in retail areas) that obstruct rowing the goods transporter.
- redesign of urban traffic spaces, speedbumps, and vehicle weight limitations.
- time-restrictions for goods delivery in otherwise car-free areas, negatively affecting distribution-routes, particularly if there is a great diversity in such regulations.

In most cities in developing countries, the freight transport system is heavily road-based, yet few roads in central business areas are wide enough to carry truck traffic without seriously obstructing other traffic. In Bangkok, Thailand, designated truck routes may prohibit truck movement on most smaller streets, and all trucks are subject to restrictions on entering the city's central area for many hours of the day, especially peak-hours, in order to keep them

from adding to congestion and pollution. Smaller cities may be confronted with dominant good vehicle flows passing through old city centres, without any origin or destination in the city.

The usual measure for goods transport is ton-kilometers, and most attention is given to heavy goods and long-distance, inter-urban transport of those goods. Equally (and sometimes more) important in many cities in developing countries are the frequent, low-volume movements for which non-motorized transport modes are best suited. The concept of *multi-modal* goods transport that combines long-distance, heavy goods motorized transport with short-distance, small shipments distribution by non-motorized vehicles is an option worth exploring.

The private sector (industry, traders, and transporters) and local authorities should be stimulated by the central government to initiate the development of freight-distribution centers and identify the best locations and the appropriate design for transfer facilities, within the context of the regional transport plan.

*Interurban transport*

The central government is most directly involved in interurban transport; it is responsible for the interurban trunk road network and—in most countries—for the national railways and inland waterways network. The national networks are supposed to provide adequate infrastructure supply levels for accommodating interurban transport services (flows of vehicles, wagons, or vessels) in response to actual transport demands. To be able to

achieve this in an ever-changing world, central governments are equipped with—or must develop as a matter of urgency—Transport Planning agencies, preferably one integrated transport planning authority at the central government level.

The fundamental issue of the transport planning process is estimating future transport demand in terms of future transport flows between the various places of origin and destination that the infrastructure networks are supposed to access. In order to assess today's situation and to provide guidance on how to achieve a preferred future situation, the transport planning authority needs to carry out a nearly permanent sequence of studies. It needs to collect basic data for monitoring the rate of infrastructure network use and to assess whether the systems are technically and financially sustainable. It also feeds this data back to market research surveys addressing transport user needs, formulating future transport demand scenario and confronting these with alternative, future transport supply options.[67]

**Table 5d. Accessibility: Interurban transport**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Interurban transport | Modal split freight and passanger transport,<br>Trunk road network,<br>Good vehicles performance,<br>Intercity bus and train services. | Specified shifts between modes,<br>Selective extensions,<br>Increased ton-kilometer production per unit,<br>Specified service levels improvement. |

The transport planning authority also applies criteria for assessing the technical, financial, and economic feasibility of the demand-supply alternatives and considers whether environmental boundary conditions and institutional and legal prerequisites are likely to be

[67] Transport data banks must not be considered or implemented in isolation from the integrated transport planning agency working with the data and must be intrinsically familiar with their (un)suitability for specific purposes.

fulfilled.[68] Usually, the planning authority employs different approaches for studying the transport demands for goods and people, although in the end both user groups are using the same infrastructure (more so for roads than for railways and inland waterways).

A problem-orientated scenario approach addresses the primary strategic issues of transport coordination, including:

- which interurban transport flows *should* (according to national-economic and environmental criteria) and *can* (from an institutional and organizational point of view) be carried by rail, by inland waterways, by pipeline, or by intercity buses?
- what are the consequences of such transport-mode-specific demands, given the present level of supply, in terms of extension or rehabilitation (replacement) and conservation (maintenance) of transport infrastructure and vehicle fleets and scheduling of services?

*Freight transport.* Estimates of interurban flows of goods are based on finding out where the goods are required. Regionalization of the country that is, sub-dividing the country into smaller geographic units (zones or districts) and analyzing the annual production and consumption of each of the relevant goods in the zones, makes it possible to estimate *surpluses* (more production than consumption) and *deficits* (more consumption than production) for the particular goods or commodities in each zone.[69] The country- or state-wide situation of surpluses and deficits, together with a number of other variables (organization of the trade, role of intermediaries, storage, and information, transport costs,

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[68] For example, cost-benefit analysis or cost effectivity analysis.

[69] Depending on the country, some 25 to 50 different commodity groups may have to be taken into consideration.

seasonal pattern, so on) determine the distribution pattern of the particular good. A national surplus leads to export opportunities, while a national deficit may call for imports.

This type of study usually called a Product Study, requires the cooperation of various ministries or their subordinate agencies, or both. These would work directly or indirectly with sector data on the required disaggregated level, for example (agriculture and irrigation, mining and petroleum, industry, and so on). Specific surveys will be necessary in addition, along with verification of the officially supplied data.

Import and export statistics obtained, for example, from international seaports and airports are a necessary complement to the product studies. Possible inconsistencies with the national surpluses and deficits need to be identified and explained.[70] Specialized port access and handling facilities (and international shipping services and domestic trading services) usually explain why particular goods reach a specific port and not another port that—from a purely transport-economic point of view—might be optimal.

Whereas product studies and export and import analyses constitute the market research (asking where the goods are required, and where they are originating?), an analysis of freight transport flows and modes of transport is concerned with the question of how to get the goods to their destination? And, within the context of a sustainable environment, an equally justified question is: what can the government do to affect the choices of goods shipped? One minimal option for road users (trucks) to pay for the direct damage they inflict on the road. But more generally, this step addresses the questions raised at the end of the introductory section:

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[70] Imports of private cars or luxury consumer goods (predominantly in containers), for example, cannot be identified or measured as deficits (or needs) at the zone level.

- what is the optimal mode of transport according to national economic and environmental criteria?
- is it possible to implement this with the prevailing or to-be-modified institutional and legal framework?

Multi-modal transport is developing of rapidly despite slow improvement of government institutions (such as customs). In the area of information technology, Electronic Document Interchange enables a separation between physical flows and the associated flow of information. Particularly in freight transport, computerized market systems that bring together buyers and sellers of transport services may be adopted quickly by the private sector; the cooperation between port authority and transport industry may be the first to benefit. Strengthening the positions of railways and inland waterways in combined transport (affecting the modal split toward more environment-friendly modes of transport) will require dedicated efforts and central government assistance, initially in the form of demonstration projects.

Information technology might also play a role in putting tighter controls on the trucking sector, primarily to improve traffic safety through registering various types of violations and accidents.

*Passenger transport*. Interurban passenger transport can be roughly sub-divided into *commuter* travel and *long-distance* travel, although the two kinds of travelers will mostly be sharing the same transport infrastructure near the central cities. Commuter travel falls

largely within the planning scope of the transport region and urban re-modelling and transport. Low-income commuters having to bridge large distances (more than 10 kilometers) often are facing great problems. Long-distance travel is potentially a challenging market for public transport (railways in the case of heavy intercity demand and buses otherwise), because public transport could compete with the private car in terms of speed and comfort. Low-income travelers making long-distance trips do not have a choice; at best they can afford the cheapest public transport mode.

A market research approach to demand analysis of long-distance travel starts from the user's perspective and will distinguish high(er)-income *choice*-travelers (those who can choose to travel by private car or public transport) from those with lower incomes.[71] In rapidly growing economies, private car-ownership and thus the number of choice-travelers may rapidly increase, as long as the government offers bright prospects for driving cars on the interurban road network and in cities.

The "choice-traveler mechanism" might actually start to work if a situation with a significant proportion of the population owns cars and is faced with serious physical or financial constraints on car-use (such as congestion and road pricing). Then, travel time and service reliability will predominantly determine the competitive battle between the private car and the collective or public transport alternative. Another question is whether massive private car ownership in a rapidly growing economy can be stopped if the government pledges to support only a limited interurban road network (and similar, restricted urban road networks) in favor of adequate public transport (rail and bus) and non-motorized transport networks.

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[71] Actually, most high-income travelers are *captive* private car users, as long as this is not made physically or financially impossible, or both.

*Rural transport*

The main transport problem of most poor rural populations is their inability to reduce the daily burden of moving small volumes of cargo over short distances at low speeds and, whenever possible, at no extra cash expense. Rural roads must not be considered in isolation from the factors that determine transport demand or from the vehicles that use them, but rather as a component of a much larger distribution system. Changes in one aspect may have repercussions on all others: improved storage, for example, could lead to a reduced need for all-weather access.

**Table 5e. Accessibility: Rural transport**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Rural transport | Pedestrians and intermediate means of transport's using rural infrastructure,<br>Fund raising,<br>Maintenance vices (workshops) for intermediate means of transport. | Regular monitoring and village level market research (surveys),<br>Government grants user-matching locally raised resources. |

The importance of off-road transport in rural areas, and its role in production and day-to-day survival, have been largely neglected. A user demand (market research) approach will underscore the interaction between motorized rural road use and off-road feeder networks. Minor investments in off-road transport and infrastructure might lead to more effective use of rural infrastructure networks. The use of intermediate means of transport would save large amounts of time and energy, particularly for women[72].

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[72] Source: "The potential of intermediate means of transport in improving rural travel and transport in Sub-Saharan Africa," J. Riverson and S. Carapetis, World Bank, 1992. "Intermediate means of transport" used here as a synonym for non-motorized transport used in the urban context.

Women in many countries do not use some modes of transport (such as bicycles) because it is not accepted culturally; other constraints are of a technical or economic nature or result from a lack of infrastructure.[73] The challenge of reducing women's transport burden lies in working with local women's groups to identify the most appropriate intervention. Bicycle use, for example, could be encouraged through cultural change, technical improvements (in frame design and strength), credit programs, and improvement of footpaths and roads.[74]

When intermediate means of transport have been introduced in the past and used in the transport system with the support of the central government, private citizens have usually taken the initiative to develop them further, for example, ox- or donkey-drawn carts, cycle-trailer, high-capacity wheelbarrow, and so forth.

Just as the transport performance of ox-carts is neglected in statistics, the phenomenon of small, non-mechanized *countryboats* and ferries in developing countries with more or less extended water resource systems has sofar received little attention. It is important to recognize their roles in goods and passenger transport for the low-income groups that have otherwise no alternative, living mainly in remote rural areas where roads can penetrate only at very high costs or cannot be effectively sustained.

Improving transport and travel systems in rural areas depends on distinct institutional and funding arrangements for rural transport infrastructure: decentralizing parts of some

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[73] Gruehl-Kipke, B., "Non-motorized (Urban) Transport Studies SSATP," Draft Report of July 1993 (unpublished) M. de Langen (consultancy support team) The Netherlands.

[74] The Grameen Bank in Bangladesh, for example, has a credit program in which bicycle loans are given mostly to women in groups of four; only when the first two have paid back their loan, do the other two women get theirs.

existing institutions, mobilizing local resources and matching these with central government grants (for example, from the infrastructure fund), and promoting local contracting. Village level participation and surveys must provide the foundation for this in the form of market research applying activity-based approaches (individual or household activity, time patterns, and budgets) to understand transport behavior and needs.

*Arrangements for captive private car users and other special categories*

Relatively high-income groups—private car-owners and users (or their children)—in many developing countries are likely to adopt a number of the more or less innovative transport solutions from industrial countries, such as car-sharing arrangements and high-occupancy vehicle lanes, park-and-ride transfer facilities, and "tele-innovations" (tele-working, tele-learning, tele-shopping). Annex C describes these subject areas as they are treated in the Netherlands Transport Structure Plan.

**Table 5f. Accessibility: Captive private car users**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Arrangements for captive private car users and other special categories | Use made of particular facilities (counts and surveys needed) | Reduced private car use, notably in peak hours (by target percentage) |

*Forming an environmental plan*

Resources available for tackling environmental problems are inevitably limited in many developing countries. It is important, therefore, that areas in which a significant

impact can be achieved relatively cheaply are tackled first. This requires knowledge not only of the major resources of pollution, but also of the technical options available and of their effectiveness, practicability, and cost.

*Environmental pollution inventory and monitoring.* Motorization concentrated in urban areas of developing countries has led, or will lead, to increased traffic congestion with consequently higher emissions and lower fuel efficiency. Increased concentrations of harmful air pollutants frequently exceed public health guidelines or standards.

An environmental strategy should start with measuring air quality on a regular basis and establishing and maintaining inventories of the sources of air pollution (monitoring instrumentation). Environmental impact must be considered throughout the entire *energy chain*, especially if the fuels are produced and refined locally (from feedstock recovery and transport, fuel processing or synthesis, product transportation and delivery and compression, to the end-user).

**Table 6a. Environment and amenity: Forming an environmental plan**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Forming an environmental plan | Activity reports of ministry of environment or concerned interdepartmental committee | Agenda and time schedule for Plan, Technical or financial assistance arranged |

It would be ineffective for developing countries to attempt to pioneer new solutions in the short term. It will be better to learn from the experience of industrial countries over the last decades, and assistance with the implementation of inventory and control strategies should be provided.

*Pollution reduction strategy.* The first priority should be restraining future increases

in vehicle ownership and use. Economic measures (such as heavy taxation on auto use) and physical planning policies (such as stringent land use controls that encourage compact urban development) should be the most important elements in this effort.

But even if overall vehicle growth would not exceed five percent a year—an optimistic assumption for cities in rapidly industrializing countries—vehicle emissions would increase explosively over the next 15 years. In addition to growth restraint, a series of multi-faceted measures addressing the sources of emissions is necessary.

*Restraining private car ownership and use*

Transport demand management instruments for restraining automobility (closely related to the preceding section on accessibility) include:

- *land-use control*. This is a crucial, albeit long-term (20 to 40 years) solution, aimed at locating large concentrations of transport-intensive functions and activities (offices, shopping centers, hospitals, and so on) at high-quality public transport interchanges. It means systematic town planning to bring schools, factories and offices, shops and recreational and other facilities into or near housing estates to minimize the need to travel far. It calls for strong political, economic and administrative urban management (see sections on institutional reform and transport regions).
- *deterrence of through-traffic in old city centers*. This will affect traveling time in favor of alternative (environment-friendly) modes of transport. If these modes are not available, they may be relatively easy to implement using primarily traffic

management measures that provide direct routes for collective public transport and non-motorized transport. This strategy of re-allocating urban traffic spaces could be implemented in the shortterm. An area licensing system may be applied to regulate entry of private motorized traffic to specific areas (such as in Singapore).

- *parking restrictions*. Physical shortages in car parking provision are most effective, provided that spaces meant for various useful urban activities can be kept free of illegal parkers and the area remains well-accessible to alternative means of transport. Another formal planning tool could be the introduction of parking norms (for example, a maximum number of parking spaces per hundred employees) limiting the parking provision at commercial firms and public facilities with adequate or excellent access by collective public transport and non-motorized transport. A step in this direction may be made by levying a parking tax on firms or by introducing a licensing system. City-wide parking charges is another option for making private cars pay for their environmental damage and encouraging the use of an alternative mode of transport. Parking fees require an adequate enforcement apparatus that can collect the charges (using fiscal-administrative procedures) and apply sanctions (wheel clamp or towing). Clearly, parking restrictions (of various kinds) require new legislation to be prepared, politically accepted, and then introduced and enforced (see section on institutional and legal framework).
- *Controlling vehicle ownership*. Increasing vehicle ownership might be curbed through fiscal disincentives such as high registration fees, road taxes and parking charges.[75]

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[75] These measures have achieved only limited success in Singapore; apparently there is ample purchasing power in a rapidly growing economy, combined with a high consumer preference for automobility.

The next step may be a Vehicle Quota System (like those in Singapore) that sets a quota on the number of new vehicles allowed on the roads.[76]

- *Road pricing and user taxes.* To regulate the use of vehicles, variable transport costs should be addressed primarily: high petrol duties and high parking charges appear to be the best strategy from an environmental point of view. Increased fuel taxes are the easiest to collect, once they are politically accepted. Electronic road pricing may be more effective than an area licensing system in controlling congestion, because it allows charges to be fine-tuned to conditions at different times and places.

**Table 6b. Environment and amenity: Restraining private car ownership and use**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Restraining private car ownership and use | Private car ownership registration, Private car "kilometrage," interurban and urban | Specific targeted growth rate limits, Land-use plans ensuring access to bus and non-motorized transport (and possibly rail) |

Any private car mobility restraining scheme, often a combination of various strategies, must be accompanied by a clear presentation of the alternatives offered in terms of collective and public transport services and facilities for non-motorized transport. Planning authorities, decisionmakers and the public, must have a reasonably clear perception of which groups will win and which will lose from the scheme, in order to design solutions that finally will be accepted in the political arena.

[76] A vehicle can only be registered with a Certificate of Entitlement, which is obtained through monthly tenders, and is valid for ten years; it must be renewed on expiration or the vehicle will be deregistered. For every vehicle deregistered, an additional certificate will be available for tendering.

*Reducing vehicle emission and air pollution*

Even if pricing policies (for the short-term) and stringent land-use reforms (for the long-term) succeed in restraining automobility, additional strategies will be necessary to reduce air quality problems.

Fuel-efficiency of motorvehicles could still be significantly increased by reducing the weight of vehicles and improving vehicle design (for example, by reducing wind and rolling resistance, and recovering energy lost in braking), and by altering some aspects of driving itself, that is driving for economy.[77]

Speed and driving techniques affect fuel consumption and hence emission of carbon dioxide; lower speed limits, if strictly enforced, and improved driver techniques could contribute a five to ten percent cut in fuel consumption.[78] Technical devices (cruise control, speed regulators, and "intelligent accelerators") might be prescribed for enforcing more environment-friendly driving styles. Preference must, of course, be given to developing vehicles that are both economic and clean. This calls for establishing legislation on stricter emission standards for goods vehicles, buses, private cars, and motorcycles and creating the instrumentation to enforce such standards.

Inspection and maintenance programs will help lower emissions from existing vehicles because vehicles that fail the test are required to be repaired, and because vehicle owners will be encouraged to take preventative action and avoid repair costs of vehicles which have

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[77] Larger and heavier cars not only consume more fuel, but also more raw materials and energy in the production process.

[78] See section on improving traffic safety.

been tampered with or misfueled. Schemes to improve the standard of vehicle maintenance and to replace old vehicles can greatly reduce vehicle emissions in a short time; they require, however, a strict and consistent policing activity.

**Table 6c. Environment and amenity: Reducing vehicle emissions and air pollution**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Reducing vehicle emissions and air pollution | Nitrogen oxides and unburned hydrocarbons, Consumption of fossil fuels, Emission of carbon dioxide by road vehicles | XX percent in 20 years times, with intermediate target of Y percent lower in 10 years (different percentages for various emissions) |

Stringent motorcycle standards may be introduced starting with substantial control, if not elimination, of highly polluting two-stroke motorcycles and reduction in the use of lubricating oil mixed with unleaded gasoline. New motorcycles with lower emissions are technologically feasible, and the introduction of increasingly strict levels of control may accelerate initiatives from the industry under "client-pressure."

More stringent car and truck standards in industrial countries have led to advances in automotive technologies, which reduced emissions from motor vehicles significantly, including diesel exhaust; rapidly industrializing countries are adopting similar stringent emissions regulations, and UNCED (Agenda 21) may inspire the international industry to further technological improvements.

Developing countries inevitably have a high proportion of older vehicles, that are passed down the *economic chain*. Because their contribution to emissions reduction is potentially high, inspection and maintenance programs should be emphasized in any air quality strategy. With a well-functioning inspection and maintenance program in place, it

will be easier to set a next step—introducing a replacement strategy for old, polluting motorvehicles.

In the mean time, the government may regulate the in-country manufacture or assembly and import of fuel-efficient and clean vehicles (for example, by requiring a "energy-efficiency impact statement").[79] Moreover, road vehicle taxes and licence fees could be raised to discourage cars with great weight, large cylinder content, and large engine power.

*Clean fuels and fuel switch*

Improved fuel quality options include unleaded gasoline (required for the use of exhaust catalysts) and lower sulphur diesel (for control of sulfur dioxide).[80] Changes to fuel quality involve significant investments in manufacturing and distribution as demonstrated by the switch to unleaded gasoline.[81] In many developing economies, only a small part of the car population has advanced emission control systems, or is likely to have them for many years. Reformulated fuels inevitably incur increased costs, increased energy consumption and emissions at the refinery, and a reduced throughput. Only few governments in developing countries attach priority to and succeed in encouraging th replacement of old

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[79] Such regulations might not be limited to fuel-efficient and clean motorvehicles but could also concern, for example, heavy goods vehicle specifications, aimed at preventing of axle-overloading.

[80] Extensive research is being conducted to develop a modified version of the petrol engine that without the use of a catalytic converter, has a low level of dangerous emissions.

[81] Technological developments underway seem to indicate that a 75 percent cleaner diesel might be available in about 15 years time.

vehicles with modern, low-emission motorvehicles.[82]

The principal alternative fuels presently under consideration, burning cleaner than diesel, are natural gas, methanol made from natural gas, and,—in limited applications and supply—liquefied petroleum gas. Alternative fuels must bear the costs of individual vehicle modification and of a new fuelling infrastructure, both of which can be substantial. A growing economy with a limited existing fuel infrastructure offers more scope for developing a network of alternative fuelling sites than a mature market. In the shorter term these alternatives are generally best suited to high-mileage or centrally-fueled fleet vehicles such as city buses and taxis.

**Table 6d. Environment and amenity: Clean fuel and fuel switch**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Clean fuels and fuel switch | Fuel-characteristics of vehicles, Emissions measures | Up-to-date registration of vehicles, Reliable statistical services, Targeted reductions of emissions |

Liquid biomass fuels such as ethanol and vegetable oils are apparently attractive: they are renewable and may reduce dependence on imported oil. They are, however, still considerably more expensive to produce than conventional fossil fuels, though the fuel market may change if fossil fuels were highly taxed and the renewables were not at all. Some governments may take the initiative to apply surcharges on fossil fuels, diesel in particular, and use the funds thus raised to create the enforcement machinery required for the inspection and maintenance program just mentioned.

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[82] Again, Singapore is front-runner in designing policies and incentives for revitalizing the vehicle population.

*Improving road safety*

The social costs of road traffic accidents, and numbers of deaths and injuries are impressive in almost any country. Annual statistics of these indicators, where possible in relation to the annual vehicle-kilometer performance (for example, millions of vehicle-kilometers driven on various road classes), demonstrate the unsafe traffic conditions in developing countries relative to wealthy countries. Another way to look at this is the relative importance of road traffic as a cause of death and in occupying hospitalbeds as compared with other causes of death or injury. The political platform determines the prominence of this problem area and may set the measurable targets for improvements over time.

An adequate reliable statistical database is a prerequisite for a traffic safety policy or, for that matter, for any *targeted* policy. As long as the subject is not prominent on the political agenda—as is the case in many developing countries—the willingness to provide the means to create the necessary statistical infrastructure will also be half-hearted at the best.

**Table 6e. Environment and amenity: Improving road safety**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Improving road safety | Number of deaths (by type of road-user?), Number of injuries (related to traffic performance per vehicle-kilometer?) | Percentage reduction within specific time-horizon(s) |

Motor-vehicle speed control outside of urban areas is the single most important instrument for reducing the number of fatal accidents. Observing speed limits is generally a controversial issue of human behavior. Central governments in wealthy countries continue to conceive measures to make car drivers aware that they drive too fast and to increase the

incidence of catching violators. Such measures are expensive and ineffective. They are expensive because of the high requirements that the control mechanism has to fulfill, beginning with the equipment on the road and its handling and going up to the juridical settlement of the fine.[83] The measures are not effective—certainly not in the long term—because they are based on limited insights into the processes that explains driving behavior. Most traffic behavior is enacted as a matter of routine. Drivers purposefully choose to drive too fast, for example, to compensate for lost time; they think that this is permitted because it is in their social and economic interest and because they have the opportunity to do so (most cars are comfortable at driving speeds much higher than the maximum speeds posted). The risks of speeding are not altogether disregarded, but various other motives for speeding also exist, such as the chance of being caught.

Information, advice, and sanctions hardly have any effect when behavior progresses almost automatically. Information, advice, and sanctions are mainly effective during the stage of *learning*. Therefore, if we have not learned the "right" behavior, there is more logic and responsibility in arranging the driving environment in such a way that misgivings in routine behavior do not result in accidents or that the results of an accident are minimized and the possibility to display dangerous behavior is eliminated.[84]

Thus, vehicles must not be permitted to drive faster than a certain speed determined sufficiently fast for a particular vehicle type; this can be technically arranged. A successful

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[83] A possible solution for the last problem is to consider the fine a tax that could be collected without interference of the public prosecutor.

[84] Traffic education, for all kinds of operators (drivers) and the public at large (starting at childhood), remains an important instrument for promoting responsible behavior (see section on influencing behavior through communications and education).

reduction of speeding would bring another benefit for the environment, notably a significant reduction in fuel and energy consumption.

Finally, it should be noted that it is not only the road-user who is responsible for undesirable behavior on roads. The infrastructure design also should be arranged to offer conditions that make dangerous behavior impossible.

*Safe transport of hazardous materials*

The risks of accidents with transport of hazardous materials, like road traffic safety in general, is not yet a priority area of government concern, in most developing countries. Nevertheless, some steps for precaution in this respect may be considered.

**Table 6f. Environment and amenity: Safe transport of hazardous materials**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Safe transport of hazardous materials | List of relevant hazardous substances,<br>Accidents (analysis),<br>Interventions of inspection agency | Maintaining numbers and consequences of accidents within specified limits,<br>Targeted reduction of violations |

Taking inventory of hazardous materials transported by various modes (road, rail, water) and route, is a first requirement, because varieties and amounts of hazardous material transport flows increase in a rapidly growing economy. Regulations must address the different modes of transpor/t involved, which should be subjected to similar safety regulations in an effort to preserve inter-modal fair competition. Attention needs to be focused not only on hazards in the traditional sense of acute and sudden dangers, but also on

those that threaten human beings in the longer term (long-term exposure).[85]

Again, there is no point in unenforced regulations; the government must be able to implement an effective enforcement machinery simultaneously as it introduces the regulations. In the short term, awareness-raising is important, with the government playing an educational and promotional role by advising the manufacturing and transport industries concerned how to act responsibly with the hazardous materials they are processing and transporting. Enforcement of vehicle or vessel specifications for the often specialized vehicles or vessels (such as double-walled tankers) and introduction and control of safer trans-shipment regulations for specific cargoes are immediate necessities.

*Cutting noise nuisance*

This problem area may not yet be of great importance in many developing countries, it is likely to appear sooner or later on the political agenda. In a city like Bangkok the noise pollution problem (among others) is severe. Equivalent Sound Levels for 24 hours of 75 to 80 decibels have been measured along heavily trafficked roads (these levels are much greater than the USA recommended 70 dB for long-term hearing protection).

Noise nuisance arises from a combination of vehicle propulsion noise and road surface (tire contact) noise. Most noise nuisance in cities is caused by heavy vehicles; at higher speeds—70 kilometers an hour or more—the tire noise of cars is predominant.

*The urban environment.* The greatest scope for improvements in the noise level of

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[85] Risk management of hazardous substances is a subject that should be incorporated in the national plan for the environment (see section on forming an environmental plan).

the urban environment lies in the area of bus and lorry traffic. In urban freight transport new visions on distribution facilities (such as bulk-breaking depots) close to major centers of trade (city centers, shopping plazas) may incorporate a system of environment-friendly (low-emission, low-noise) final-delivery vehicles. Moreover, electric traction resulting from advances in battery technology or the application of natural gas may serve to power buses.

**Table 6g. Environment and amenity: Cutting noise nuisance**

| (Partial) problem addressed | Measurable indicator | Targeted improvement |
|---|---|---|
| Cutting noise nuisance | Noise levels,<br>Area and number of housing facilities | Total area and number of facilities exposed to noise levels in excess of XX decibels to be reduced by YY percent in year ZZZZ. |

In a more general way, the restructuring of urban road networks, such as the concentration of traffic on primary roads thereby relieving other roads, will contribute to noise reduction in areas where this is considered important. Central government grants for urban road network remodeling will provide incentives for this.

*The inter-urban/non-urban environment.* Quiet road surface construction (such as a open asphalt concrete) may also be applied in developing countries. These countries may also benefit from research, conducted by the wealthy countries with the goal of achieving greater reductions than the presently achieved reduction by two to three decibels. National road pavement standards and specifications should be adjusted in this manner. Lower motorway speed limits, effectively enforced, could provide a noise reduction of about two decibels. Of course, this is only one motive for enforcing reduced speed limits (see section on improving road safety).

In rail traffic, too, noise-limiting measures may become an issue of political significance. It should be possible to reduce noise levels of rolling stock by five to ten decibels, applying a range of technical interventions. Subjecting new rolling stock to type-approval specifications seems the instrument for ensuring that the latest environment-friendly technology will be adopted.

**First steps in getting a Transport Structure Plan going**

In designing a proper long-term planning structure necessary for a Transport Structure Plan, a distinction can be made between the main *actors*, the major *intervention areas*, and the essential *capabilities* required by the actors to undertake the interventions.

The main actor groups include:

- central government
- local government, sub-divided into:
  - urban transport region administration (such as municipalities)
  - rural administration (for example, districts)
- transport organizations or operators (the "supply side")
- transport users or communities (the "demand side").

The major intervention areas are those of:

- legislation and finance, with a need to focus on:
  - law and regulation enforcement

- funding mechanisms (collection of user charges; allocation of funds)

- science and technology application, broadly sub-divided into the areas of:
  - transport planning (social sciences)
  - traffic management (engineering)
  - vehicles (including engines)
  - Fuels

- behavior and attitude change, using means of:
  - communication
  - education.

The basic capabilities needed are:

- organization of decisionmaking, to be properly arranged in two ways:
  - horizontal (inter-departmental; inter-district)
  - vertical (coordination of administrative levels; public-private)

- knowledge and skills, to be created or upgraded through:
  - training, possibly aided by external technical assistance
  - research, building on acquired skills.

A first step still to be taken in many developing countries is capacity building at the local government unit level, while simultaneously improving the vertical organization of decisionmaking. The central issue or theme should be Integrated Urban Accessibility

Planning and Integrated Rural Accessibility Planning, respectively.[86]

Integrated Urban Accessibility Planning and Integrated Rural Accessibility Planning consist of the following main elements:

- An assessment of the access problems in the defined area concerned.
- An identification of the interventions either in the transport system or in the siting of services in demand that could improve accessibility.
- Selection and prioritization of the intervention locations.
- Formulation of suitable types of interventions.
- Guidelines on the cost of the interventions.

In practice this may be carried out through an initial training program with the local government units that explains the concepts of Integrated Urban Accessibility Planning and Integrated Rural Accessibility Planning and develops local staff skills in the procedures of data collection. This is followed by data collection, an analysis of the data, and the development of a first draft action plan. These are discussed in a second training program, where the data are validated and the process of finalizing the action plan is explained.

The output of Integrated Urban Accessibility Planning and Integrated Rural Accessibility Planning is a set of defined and prioritized interventions to improve the citizen access that can be used by local government units in the allocation of their own resources, by non-governmental organizations or line agencies for specific sector program; and for

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[86] For the integrated rural accessibility planning concept see, for example: *Philippine Development* No.6, November-December 1992.

developing project packages for external (co-)funding. It is important to create vertical administrative coordination up to the level of the central ministries of transport, local government, planning, and finance and to get Integrated Urban Accessibility Planning and Integrated Rural Accessibility Planning procedures institutionalized within the national planning system.

The training materials developed in the Integrated Urban Accessibility Planning and Integrated Rural Accessibility Planning process need to be integrated in the education system, for example in the training arm of something like a local government academy. The Integrated Urban Accessibility Planning and Integrated Rural Accessibility Planning approach should also be promoted and developed further in a continuing dialogue with professional organisztions, such as a league of local provincial or municipal planning officers or a center for public administration.

The participatory approach is emphasized by the importance attached to a thorough data collection system that uses the household as the focus of the planning process, and considers the needs of household access within the context of economic and social aspects, (such as subsistence).

The introduction and dissemination of a Integrated Urban Accessibility Planning and Integrated Rural Accessibility Planning process will certainly need central government financial support to develop a market for the product in the local governments, with a possible important role for non-governmental organizations.

Any of the problem/policy areas related to accessibility and environment and amenity could be usefully addressed in this roughly sketched Integrated Urban Accessibility Plan and

**Integrated Rural Accessibility Plan.**

# Colophon


| | |
|---|---|
| Principal: | Ministry of Transport, Public Works and Water Management, The Netherlands |
| Project: | Background Paper for the *World Development Report* 1994 |
| Title: | A Transport Structure Plan |
| File number: | H 4205.01.001 |
| Contract number: | 111197 |
| Date: | November 29, 1993 (edited August 1994) |
| Project director: | R.J. Vaandrager |

# Annex A

## What is a "crucial planning decision?"

Crucial planning decisions are authoritive documents, signed by one or more cabinet ministers on behalf of the full cabinet, outlining major components or instruments of the national land-use development policy.

Crucial planning decisions are authoritive because they take into account opinions and advice of all interested and concerned actors and because of the sound procedure, similar to that for establishing a formal law, according to which they are prepared and established. They are not, however, legally binding for citizens as laws are, moreover, a full commitment by the government administration may be lacking. The adherence to a crucial planning decision is therefore not self-evident.

The procedure is characterised by five steps:

1. Concerned minister(s) decide on designing a new crucial planning decision. The draft plan is the result of an intensive study process involving frequent interdepartmental (horizontal) and inter-administration (vertical) discussions. The draft plan (part A) forms the basis for the next steps in the procedure.

2. The perspectives (definition of problems, visions about the future, norms and values worthwhile adopting, and problem solving directions) and the policy statements (specific objectives to be achieved with certain means and inputs within certain time frames), presented in the draft plan, are exposed to the critical review of many advisory agencies and numerous commentators, from the private and public sectors. To that end, the plan is put on public display for at least one month in many public places in the country. At the same time, the concerned minister(s) will solicit the advice of the "National Board for Physical Planning," and confer with the various local government agencies, involved either directly or indirectly in the sector. The result of all consultations and discussions will be compiled and published as part B of the plan.

3. The advice of the National Board for Physical Planning will be published as part C; the crucial planning decision obtains its authority from the synergy of inputs and reactions of many relevant parties and individuals.

4. On the basis of all comments obtained (in parts B and C), the concerned minister(s) will revise the draft plan and compile the final cabinet proposal or "decision" (part D), which is submitted to Parliament together with all preceding parts.
5. After parliament has approved the plan, it will become official policy (part E). Part E is jointly subscribed by parliament and the cabinet.

This entire process may take at least two years.

# Annex B

1. Key elements of urban transportation system.
2. Sectors, needs, constraints and alterables—according to F.C. Kohli (Tata Consultancy Services, Bombay, India).

**Table 1: Key Elements of Urban Public Transportation System**

1. Population density
2. Environmental pollution
3. Investments in the transport sector
4. Traffic congestion
5. Transport infrastructure
6. Employment opportunities in the city
7. Land use pattern
8. Transport related accidents
9. Migration to the cities
10. High density travel corridors
11. Encroachments on the roads
12. Goods vehicular traffic
13. Available road space
14. Traffic engineering and management
15. Training of drivers
16. Trip generation
17. Transport technology
18. Population growth
19. Information technology
20. Government policy
21. Internal generation of resources
22. Industry/commerce/service sectors
23. Traffic discipline
24. Quality of travel
25. Transport planning
26. Cost of operations to the transport organizations
27. Profitability of transport organizations
28. Vehicular growth
29. Public transport
30. Personalized transport
31. Transport organization structure
32. Riding quality of roads
33. Coordination with other formal authorities
34. Roadworthiness of vehicles
35. Public awareness
36. Efficiency of transport organizations
37. Duration of travel
38. Fares in public transport
39. Support of organized action groups
40. Accessibility by public transport
41. Public agitations and disruptions
42. Trade unions
43. Fuel consumption
44. Concentration of destinations
45. Socio-economic parameters
46. Modal split
47. Implementation of plans
48. External generation of resources

# Annex B (continued)

## Table 2: Sectors, needs, constraints and alterables

### Sectors

Users
Government
Society
Political parties
Transport organization
Urban development authorities
Municipal authorities
Traffic police
Employees of the transport organizations
Drivers
Social groups
Trade unions
Pedestrians

### Constraints

Political intervention
Activities of social groups
Inadequate resources
Imposed fare structure
Land-use pattern
Inadequate road maintenance
Encroachments
Congestion
Available road space
Traffic mix
Lack of infrastructure
Imposed employee/bus ratio
Improper vehicle maintenance
Increasing personal vehicles
Fuel availability
Density of population
Increasing demand for travel
Urban sprawl
Geographical concentration of destinations
High population growth rates
Agitations

### Needs

Safety
Security
Speed
Reliability of services
Affordability
Accessibility
Comfortable journey
Parking facilities
Fast travel
Cost optimization
Financial viability
Adequate resources
(financial, managerial, physical)
Traffic sense
Vehicle maintenance
Road maintenance
Integrated Planning
Good driving habits
Protection of commuter rights
Proper land use planning
Coordination between local bodies
Reduce congestion
Public awareness
Efficient use of road space
Adequate space for loading/unloading of goods
Fuel efficiency
Pollution control
Rational routing
Increased productivity of public transport
Vehicle productivity
Coordination between different transport systems
Fuel conservation
Timely implementation of plans
Alternate modes of travel

### Alterables

Personal transport
Traffic mix
Transport technology
Information technology
Parking facilities
Fare structure
Traffic sense
Government policy
Land-use planning
Vehicle maintenance
Pollution levels
Available resources
Traffic engineering
Traffic management
Integrated planning
Operational efficiency
Adherence to rules
Fuel consumption
Traffic density

# Annex C

Some examples from the Netherlands Transport Structure Plan (1990):
1. tele-innovations.
2. car-sharing.
3. transfer facilities.

**Policy Catergory 2:** Managing and restraining mobility
**Policy Area 10:** Tele-innovations
**Target Scenario:** Applications of telecommunications and information technology will have reduced car use notably at peak times

**Tele-working**

Economic growth and the rapid development of telecommunications and information technology are increasingly leading to the automation of production and distribution processes. A sizable group of well-trained workers who currently have relatively little free time will seize the opportunities now becoming available of greater flexibility, in terms of both time and tasks, by working at home or in shared office facilities. The growing time and money cost of commuting will encourage this trend. Part-time workers, for whom traveling time represents a disproportionate cost, will also find tele-working an attractive option.

A trial within the Ministry of Transport and Public Works was announced in Part A; it is now underway, and depending on its results and those of a further experiment (yet to begin) involving shared collective office facilities the Ministry will promote the further spread of tele-working.

**Tele-learning**

The growing size of institutions of secondary and higher education may provide a fertile environment for tele-learning. The goal here is not simply to limit car traffic but also to shift usage of public transport (and the bicycle) from peak to off-peak, bringing benefits in terms of both public-transport efficiency and safety. The Ministry of Transport and Public Works will assist with a tele-learning experiment involving a multi-lateral school in Tiburg, and if the results appear promising other schools will be invited to follow suit.

**Tele-shopping**

Tele-shopping has yet to take off on any scale. Even so, the car will in the future become a less attractive option for shopping purposes with the widespread introduction of advanced viewdata systems on the lines of the French Minitel will enhance the attractions of shopping from home. Such a development will also help the infirm. Central government sees only a modest role for itself in this area—it is for industry to take the initiative—but support will be given to schemes with a positive impact in the transport field.

# Annex C (continued)

**Policy Catergory 3.1:** Accessibilty—passanger transport
**Policy Area 16:** Car-sharing
**Target Scenario:** By 2010 the average number of people traveling in each car being used for commuting will have risen from 1.2 to 1.6

**Introduction**

On average, cars carry 0.5 passengers in addition to the driver; the position in commuter traffic is considerably worse, with only car in five carrying a second person. Even so, as many people travel to work in cars driven by someone else as commute by public transport—13 percent of all passenger-kilometers in each case—and there is every reason (not least the zero marginal cost) to encourage the practice.

Various attempts have been made in the past to encourage car-sharing but with little success: publicity campaigns, demonstration projects, even the institution of a National Car-Sharing Register, have failed to persuade people to travel together. Evidently, the individual benefits are too small.

Measures to give a new impetus to car-sharing now under consideration include:

- greater benefits (in terms of journey time, guaranteed parking, cost) as compared with driver-only cars;
- more effective matching of partners through an employer-focused approach;
- general information and awareness campaigns;
- research into ways of improving surveillance of parking facilities for car-sharers.

**Benefits for car-sharers**

*Beating congestion.* Congestion will remain a problem at many points on the road network for some years to come, and in this situation a great impetus can be given to car-sharing if vehicles carrying more than one person are enabled to by-pass the tailbacks. Ways of giving car-sharers a significant advantage over lone drivers in terms of journey time include separate lanes and priority access to the trunk-road network (see also Policy Area 14).

*Toll exemptions.* Reserved lanes for cars carrying more than one person make it possible to charge them lower tolls (or none). Flow-control systems too can give priority to shared vehicles.

*Fiscal incentives.* The legislation to cap income-tax relief for commuting cost also provides for a fiscal incentive for car-sharing. Car-sharing always benefits those involved financially and the incentive scheme enables that benefit to be enhanced.

*Parking.* Places are needed at appropriate points on the trunk-road network where people who intend completing their journey in someone else's car can park their own, and the Department of Public Works will ensure that such facilities are provided. In addition steps will be taken in conjunction with industry to ensure that car-sharers have a guaranteed parking space at their workplace. The employer-focused approach (Policy Area 30) is the appropriate framework here.

# Annex C (continued)

**Policy Catergory 3.1:** Accessibility—passenger transport
**Policy Area 17:** Transfer facilities
**Target Scenario:** Special terminals will facilitate the combined use of the car and public transport for the purpose of commuting from rural areas.

**Facilitating the switch to public transport**

A proportion ot today's car users would be happy to switch to public transport if it met their needs. Both public transport and the private car have their strong and weak points: public transport can carry large numbers of people in environment-friendly and space-efficient fashion but is not always there; the private car provides individual transport where and when it is needed but is space-hungry and destructive of the environment.

What is needed is an attractive way of linking car use with public transport, and the transferium or park-and-ride terminal (whose appeal can be enhanced by additional facilities such as shops and vehicle service stations) offers this possibility. Achieving the target scenario will require solutions tailored to particular situations. Transferiums must be of the right type and size and in the right places if they are to work.

**Location and type**

Promising options include small-scale park-and-ride facilities near people's homes, large parking areas at rural stations located at the start of a corridor (for example, Lage Zwaluwe) and multi-story car parks beside or on top of stations at the edges of metropolitan regions (for example, Utrecht-Westraven). The successes of such schemes depends crucially on direct access to high-grade public transport and back-up in the form of tight parking restrictions in the destination areas.

Large-scale park-and-ride terminals on the fringe of metropolitan regions have a further benefit: by reducing the need for city-center car parks they allow land that would otherwise be used for parking to be developed for business purposes, making for a more efficient use of space.

**The next step**

The government will work with the public-transport undertakings, provincial and municipal authorities and the ANWB motoring organization to identify the best locations for transfer facilities and the most appropriate designs. A competition will be held for the most promising locations and the government will actively support the implementation of the winning designs. Support will also be given to spontaneous initiatives at promising locations.

In the initial stage the government will fund some of the costs of operation; more definitive managerial and operational arrangements (which should normally be self-financing) might involve the public-transport undertakings, since the ultimate aim is to offer the traveler the combination of parking facility and public transport as a single product.

The current 50 percent grant arrangement will apply to facilities in the form of conventional car parks. Some of the existing park-and-ride car parks, particularly in the cities, can no longer serve their intended purpose as a result of abuse. Following evaluation an investigation will be made, with the operators of the facilities, to determine how their proper use can be promoted.

# Annex D

Simplified example of distribution of costs of a **road fund.**

Suppose we need a road (conservation) fund of US$: 100 million a year
Road conservation is sub-divided into "fixed" and "variable" parts
We suppose that 25 percent of road conservation is "variable"
The costs are distributed over three road vehicle categories.

| | Private car | Pickup/bus | Truck | Total |
|---|---|---|---|---|
| Number of vehicles | 400,000 | 20,000 | 140,000 | 560,000 |
| Kilometers a year | 10,000 | 20,000 | 35,000 | |
| ESA/vehicle | 0.0001 | 1 | 1.8 | |
| ESA-kilometers/vehicle/year | 1 | 20,000 | 63,350 | |
| Vehicle-kilometers (min) | 4,000 | 400 | 4,900 | 9,300 |
| ESA-kilometers (min) | 0.4 | 400 | 8,869 | 9,269 |
| Costs per vehicle-kilometer | 0.0081 | 0.0081 | 0.0081 | 0.0108 |
| Costs per ESQ-kilometer | 0.0027 | 0.0027 | 0.0027 | |
| Costs per vehicle | | | | |
| based on vehicle-kilometers | 80.6 | 161.3 | 282.3 | |
| based on ESA-kilometers | 0.0 | 53.8 | 170.3 | |
| Total income (min US$) | 32.3 | 4.3 | 63.4 | 100 |
| Share in total | 32% | 4% | 63% | |

The table shows that trucks should contribute 63 percent, taking into account both vehicle-kilometers and axleload-kilometers. These charges must now be distributed over two sources of income: road tax and fuel tax. Suppose the following breakdown (Road/fuel tax: 50/50 average):

| | Road tax | Fuel tax | Road tax/vehicle (US$/year) |
|---|---|---|---|
| Private car | 30% | 70% | 24 |
| Pickup/bus | 40% | 60% | 86 |
| Truck | 60% | 40% | 272 |

The dedicated (average) annual road tax required per vehicle-category, feeding the Fund, is indicated in the right column. This would be in addition to any present road tax rates, if these remain flowing into the general budget ("surcharge" roadtax).

# Annex D (continued)

The fuel tax then further depends on fuel consumption in the country. Suppose these are at world market price level: $0.33 a liter for gasoline and $0.27 a liter for diesel (at pump).

| Fuel tax | Gasoline | Diesel | | Total income |
|---|---|---|---|---|
| Price (US$ a liter) | 0.33 | 0.27 | | |
| Consumption (min liter) | 566.7 | 700.0 | | |
| Tax (US$ a liter) (surcharge?) | 0.044 | 0.036 | | |
| Income (US$ min) | 25.2 | 25.4 | | 50.6 |
| **Road tax** | **Private car** | **Pickup/bus** | **Truck** | |
| Number of vehicles | 400,000 | 20,000 | 140,000 | |
| Tax (US$ a year) | 24 | 86 | 272 | |
| Income (US$ min) | 9.7 | 1.7 | 38.0 | 49.4 |
| | | | | 100.0 |

Overall contribution of private car and pickup/bus (gasoline): 36.6 37 percent
Overall contribution of truck (diesel): 63.4 63 percent

Overall picture of fuel tax, if brought at (international) level of 20 to 25 percent

| | Road fund | General budget | Total |
|---|---|---|---|
| Gasoline (suppose super) | 0.044 | 0.038 | 0.083 |
| Diesel | 0.036 | 0.018 | 0.054 |

Variables: Diesel/gasoline prices/tax rates; road/fuel tax ration; annual vehicle-kilometers; Funds needed