

# **THE SIGNIFICANCE OF NON-MOTORISED TRANSPORT FOR DEVELOPING COUNTRIES**

## **STRATEGIES FOR POLICY DEVELOPMENT**

**A study on the effectiveness of non-motorised transport in relation to economic growth, reduction of poverty and quality of life in urban areas and on the applicability of arrangements developed in the Netherlands.**

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# CHAPTER 1 NON-MOTORISED URBAN TRANSPORT STRATEGY – A REVIEW OF DUTCH EXPERIENCE

## 1.1 Background to this study

This paper contributes to the World Bank's Urban Transport Strategy Review. This review is the first comprehensive and detailed examination of this subject since the previous Urban Transport Strategy was published in 1986. Its aim is to be informed and supported by a series of other papers as well, collating experience and best practice on different topics in urban transport. The papers, of which this document is one, identify critical problems and issues, the outcome of interventions, organisational models, etc. The papers will be widely disseminated as the basis for improving understanding and collaboration in the field of urban transport in developing countries. The Strategy Document will reflect this digest of experience.

Through the Netherlands Trust Fund, the World Bank is funding a number of reviews of relevant Dutch experience in urban transport. Both direct experience in developing countries and experience within The Netherlands are included. The general objective of the studies is to define if, and in which way, Dutch experience in urban transport planning and administration in large and medium size towns is adaptable to other countries, and under which conditions.

Non-motorised transport (NMT) plays a dominant role as an affordable, but sometimes unpleasant and dangerous, main mode of transport in some of the very poor countries. The consequence is that it is frequently associated with poverty, low-tech and not innovative, as something that countries aim to develop out of. It is beginning to play an increasing role, albeit usually as a convenient and non-polluting local distribution mode in multi-modal systems, in a number of high income industrialised countries such the Netherlands. The World Bank is particularly concerned to ensure that the strategy, which it pursues for urban transport development, is sensitive to the need for proper utilisation of the potential of non-motorised transport. The assignment of Interface for Cycling Expertise Holland (I-CE) to produce this report is evidence for the legitimate role of non-motorised transport in urban transport development.

## 1.2 Objectives of this study

The objective of the study is to identify the factors determining the effectiveness of non-motorised transport in contributing to the health of the city economy, as well as the impact on the quality of life in developing countries. The study will also pay attention to the question of the applicability of arrangements developed in the Netherlands in developing countries.

## 1.3 Expected output

The study aims to produce the following output:

- Appropriate roles of NMT at different stages for development identified;
- Opportunities for NMT in developing countries, including suggested key actors and necessary actions to be included in NMT strategies identified;
- Factors which may limit the use of, and any systematic biases against NMT in developing countries identified;
- Criteria for the separation and/or integration of motorised and non-motorised road-users suggested;
- Potential gender and cultural biases for NMT use identified and approaches to overcome these identified;
- Benefits of the low income population from improvements in NMT conditions highlighted;
- Circumstances in which NMT should be encouraged as a mode of public transport in developing countries specified;
- Options for financing NMT interventions suggested; and
- Information on costs and benefits of most important interventions provided.

## 1.4 Activities

This paper results from the analysis of reports on Dutch experiences, research and policy; a series of interviews; and the international seminar "Velo Mondial 2000" held in June 2000 in Amsterdam.

Members of the sounding board have discussed the draft report and provided the consultant useful information, advice and recommendations.

## 1.5 Organisation of the report

In this report we will consider the significance of non-motorised transport for individual mobility and user costs, for traffic management and road safety, for the city climate and economy, for health and the environment. We will support this with calculations and estimations regarding the economic costs to invest in facilitating walking and cycling and the benefits as a result.

Though walking and cycling have common interests in claiming a treatment as fully-fledged modes of transport and as therefore ask for good planning and facilities, we will also pay attention to conflicting interests between the two.

The paper presents a synthesis of the outcome of aforementioned activities. In chapter 2 a general introduction will be given about the importance and functionality of NMT in the Netherlands as well as in developing countries. Reference is made to the role of NMT during different stages. It provides insight in the social, economic and cultural dimensions of NMT use and attitude and perception of NMT-users and non-users. Furthermore, a model will be presented that helps to explain the use of NMT.

Chapter 3 identifies and describes the actors or stakeholders in NMT development, institutional and policy arrangements as regards NMT development. It will focus on the development of NMT in the Netherlands. The chapter will deal with lessons learned from the Dutch approach, as well as its applicability for other countries. Financing mechanism for NMT-interventions and capacity building will be discussed in more detail.

Chapter 4 will be about planning for cycling and walking. We start with some discussion about transport management and planning, specific and generic planning. During the planning process there are several moments that NMT and MT interests should be weighed. Section 4.4 explains at what moments that might take place in three different settings. We will continue with a practical example from the Netherlands and Delhi concerning the use of networks as a basic planning concept. The development of an urban mobility plan for pedestrian and bicycle traffic is explained after that. In a growing number of countries 5 major criteria for NMT planning are used. In section 4.7 we will



elaborate on that. Chapter 4 will be concluded with a section on the safety management approach.

Chapter 5 focuses on technical issues; it kicks off with some views on the issue of segregation versus integration. The chapter continues with arguments for using a hierarchy in the urban road network system for planning purposes. The mobility improvement menus as they have been used in the SSATP programme will be reviewed. The facilities for pedestrians and cyclists will be studied in detail. Finally, the costs and benefits of NMT interventions will be highlighted, as they have been calculated for 4 cities (I-ce) and SSATP.

In chapter 6 the biases and impediments for NMT development and options to overcome these will be discussed. Furthermore, we present an overview of user participation models and conclude the chapter with organizational conditions to be met.

Chapter 7 defines objectives or principles for the development of NMT. It will elaborate on three principles, i.e. quality of life, economic growth and poverty reduction. It will show NMT's contribution in achieving the objectives. Suggestions are made with respect to potential strategies for achieving the above-mentioned objectives.

In the final chapter, we will draw conclusions and discuss about a suitable approach to promote NMT use in developing countries. We will conclude with specific recommendations for the Bank and some recommendations about planning for NMT in general.

Before we kick off with chapter 2, the introductory chapter, the reader is referred to Annex 1 for the Terms of Reference for this study and Annex 2 for the study planning matrix, in which objectives, output and activities are mentioned.

In the remaining of the paper Non-Motorised Transport will be abbreviated with NMT. NMT includes all means of transport that are human powered. In our paper we primarily focus on cyclists and pedestrians. Because of lack of available data we will not focus on non-motorised freight transport, unless otherwise stated.

## CHAPTER 2 NON-MOTORISED URBAN TRANSPORT

### 2.1 Non-Motorised Transport in Developing Countries

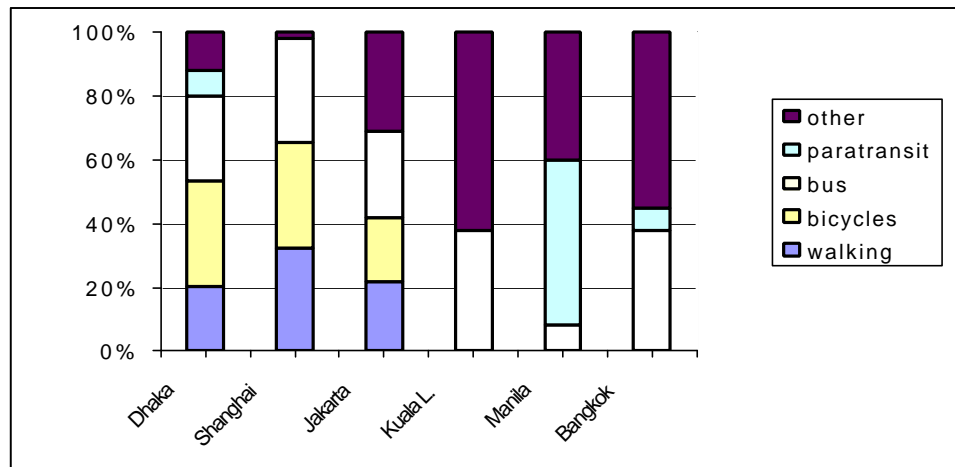
*“Reduced Mobility and limited accessibility have become a major problem for the Arequipa Metropolitan region and its urban transport system. The problems are exacerbated by inefficient traffic management and poor driving behaviour, aside from the lack of adequate transport facilities and related infrastructure. Congestion and absence of adequate emission standards and control systems have attributed to air pollution and noise levels, especially within CBD’s limits. Moreover, local climatic patterns are becoming favourable for thermal inversion, thus creating potential transport related health hazards. Increased travel distance and time spent on daily trips for basic activities, caused by urban growth and restricted modal split options have resulted in increased car ownership and use” (Zuniga, 1996<sup>1</sup>).*

So far the excerpt of the report on sustainable transport in Peru. The reason why we start this chapter with this rather extensive quote is that it shows perfectly well the situation in which many urban areas all over the world are: diminishing mobility and accessibility, worsening health and environmental situation, lack of transport facilities and infrastructure, poor planning and traffic management and neglect of multi-modal transport systems. In such a harsh environment, NMT was and is put under quite serious pressure.

But let’s return to the relevance of NMT-modes in developing countries. It is correctly claimed that NMT is an integral element of urban transport in developing countries world-wide. Its significance and function varies per continent however. In several countries in Asia, China on top, cycling has been the most or at least second most important means of urban transport.

The available figures for walking are highly inaccurate. There are major differences between data sources.

Figure 1 shows the share of various modes in 6 Asian cities. In Indian cities the share of NMT at peak hours ranges from 30 up to 70%; trips undertaken by bicycle account for about 10% to 35% of the total trips<sup>2</sup>. Bicycles are not only important for the entire trip (from origin to destination), but, particularly in developed countries, also as a feeder mode to public transport. In a rich country like The Netherlands, 27% of all trips is by bicycle, whereas only 5% is by public transport. Although bicycle trips to and from public transport stops are only a small proportion of the total number of bicycle trips, it is true that the bicycle has a role to play when it comes to the promotion of public transport. Its potential as feeder system is very high.



Source: International Road Federation, 1998.  
 Figure 1 Modal share for various Asian cities (\*other = including cars)

Walking remains important too as a mode in an integral transport system. The case of Africa shows that in Nairobi and Dar es Salaam for instance nearly half of the trips are entirely made on foot, whereas for the remaining share a combination is made of public transport and walking. Just only 10% rely on private motorized transport. The dependence on NMT is even higher in secondary (-sized) cities. The finding that public transport plays an important role in urban transport, as shown for some Asian cities in the figure above, is also true for many other cities in the developing world. In a large number of cities, especially in Asia, the share of buses and trains is high; they are widely used by the middle income and poorer sections of the population. Walking is in many developing countries the most important means of transport, followed by public transport. Cycling has a smaller share of total number of trips, except for a few (big) exceptions

The function of bicycles differs widely between the continents. In Asia and Africa, generally spoken, bicycles serve as a means of transport of goods and people, while in the Americas the recreational purpose of cycling is important. About trip purposes hardly any statistical data is available. The "local background study" provides some insight in trip purposes in 5 selected cities. Table below presents the findings. As can be seen, the bicycle is primarily used for going to and from work. In Delhi this is by far the most important purpose. The suggestion that in Latin America the bicycle is used as a means of recreation is not supported by these findings. However, this probably has to do with the organization of the specific surveys in Lima and Leon; the surveys took place at moments that no recreational use of bicycles can be expected.

Table 1 Percentage of each trip purpose in total bicycle use

Trip purpose	Accra	Delhi	Guangzhou <sup>1</sup>	Leon	Lima
Commuting	31	72	45	44	46.2
Business/goods transport	4	10	40		4.5
School	8	14	10	Very little	25.2
Shopping	24	2	10	High	10.5
Leisure	33	2	30	Very little	6.8

<sup>1</sup> This column shows percentage of trips per bicycle for each trip purpose.

Experts from Guangzhou (China) and Delhi (India) expect that the share of bicycle trips will reduce in future due to a rise in income per capita. Economic growth and urbanisation trends will cause a higher demand for means of public transport. Since NMT will continue to be part of the overall transport system, the functioning of NMT should be considered if one aims to improve the efficiency of the public transport system.

## 2.2 Non-Motorised Transport in The Netherlands<sup>3</sup>

NMT takes a significant role in The Netherlands. Not only in cities, but also in suburban and rural areas NMT plays a crucial role in mobility of people. With a total population of about 16 million, the number of bicycles is impressive: it equals the population. In all other countries such a density of bicycles (1.0 per capita) is unseen. Only in Denmark and Germany figures come close, i.e. 1.1 and 1.3 inhabitants per bicycle respectively. Table 2 gives some more insight in popularity of having a bike. It brings us to the conclusion that bicycle ownership is particularly high in West-European countries.

Table 2 Bicycle ownership in various countries

Country	Ownership (x 1.000)	No. Inhabitants per bicycle	Country	Ownership (x 1.000)	No. of inhabitants per bicycle
Netherlands	16,000	1.0	France	20,000	2.8
Denmark	4,500	1.1	Brazil	40,000	3.5
Germany	62,000	1.3	Mexico	6,000	13.2
China	450,000	2.6	India	30,800	24.4
USA	100,000	2.6	Indonesia	2,300	66.5
England	20,000	2.8			

Source: RAI, The Netherlands 1998

From this table the actual use of the bicycle can not be derived. There is however a positive correlation between rates of use and ownership. Functionality of NMT is actually rather diverse. In some countries the bicycle plays a foremost recreational function (USA, Peru and Brazil), whereas in others its function is mixed (The Netherlands and Denmark) or merely for transport purposes (China and India).

The function that cycling has played in The Netherlands as well as its importance has changed over time. From 1870 till 1900 cycling had a pure recreational and social status function. Bicycles were expensive. Only higher class people could afford such an

investment. At the beginning of the last century, though prices were still high, the bicycle became more accessible to other classes as well as a result of economic growth and higher incomes. From 1920 till 1950 the bicycle was a necessary, and for most people only means of transport. Its role then became essential in everyday life. Both usage of car and public transport was expensive. Moreover, urbanisation and concentrated forms of working and living in cities did not hamper the dominant role of bicycles. From 1950 till 1975 however, the bicycle got a negative image. In the rapidly developing economy of post-war Netherlands, the bicycle represented the past. This idea about bicycles prevails in many developing countries nowadays. Further, a process of suburbanisation and long-distance commuting undermined the position of the bicycle even more. Urban planners were primarily engaged in providing a suitable environment for motorised traffic. It lasted till 1975 that the negative image of cycling changed due to the combination of serious accessibility problems of the inner-city, increased environmental awareness and political activism. The bicycle is rediscovered by individuals, and used for both utility, health and recreational purposes<sup>4</sup>. The Government is rediscovering the bicycle as a quasi-collective item, and stimulates its use in order to reduce the negative external effects of car use and to increase the mobility in urban areas. For example, the Government provides subsidies and tax reductions to reduce cost price on sales and repairs (by lowering the VAT) and invests quite significantly in infrastructure. The trend of bicycle ownership is clearly visible from the below figure. As a comparison, the Danish cycling experience has also been shown. Although the actual values are different, the shape of the curve is similar in many European countries: relative high proportions of cycling between the thirties and fifties, a decline of cycling coinciding the mass motorization, and a rediscovery of the bicycle (may it be on lower levels) in the last decades of the 20<sup>th</sup> century.

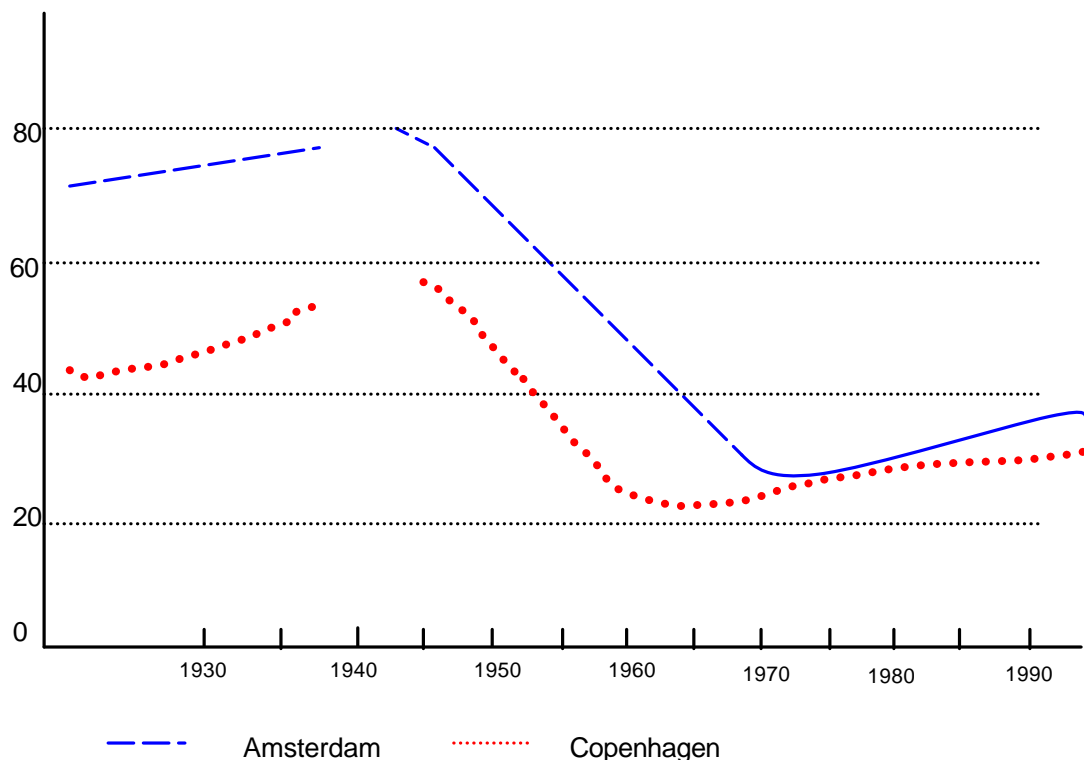


Figure 2 Trends in modal share for bicycles in total trips in 2 cities, 1920-1995.

The below table shows the bicycle share in commuter traffic trips for each distance class between 1982 and 1995. It shows that the overall bicycle share is stable, i.e.

around 27%. Since total mobility has increased during that period, it means that an actual increase of number of bicycle trips has taken place. The share of cycling in short trips (< 5 km) has grown in 1995 compared to 1982 with 6 to 7%. The increase in this distance category is primarily at the expense of the car. But as trips tend to become longer, and the share of cycling for the longer distance category is lower than for the short distance trips, the overall share of cycling is more or less stable. In fact the growing share of longer trips might turn out to be the biggest threat for the future role of cycling.

Table 3 Change in share of cycling in commuter trips per distance class in the Netherlands, 1982 -1995 (%).

	1982 – 1984	1986	1990	1995
0 - 2.5 km	47.9	48.1	49.4	52.1
2.5 - 5 km	43.1	45.2	51.4	51.1
5 - 7.5 km	27.4	27.1	31.0	32.5
7.5 - 10 km	19.7	21.1	22.9	24.2
> 10 km	4.3	4.3	3.6	4.2
Total	27.7	26.8	27.9	27.4

Source: The Dutch Bicycle Master Plan (1998)

Table 4 Modal share per distance category (1995)

	Bicycle	Passen- ger car driver	Car passen- ger	Public transport	Walking	Other	Total
0 - 2.5 km	16.1	7.4	2.3	0.3	14.6	0.6	41.3
2.5 - 5 km	6.6	5.9	2.1	0.5	1.3	0.4	16.7
5 - 7.5 km	2.8	5.4	2.0	0.6	0.5	0.4	11.8
7.5 - 10 km	1.6	6.6	2.2	1.1	0.1	0.4	12.0
> 10 km	0.7	9.7	4.5	2.8	0.1	0.5	18.2
Total	27.8	35.0	13.2	5.3	16.6	2.1	100

Source: The Dutch Bicycle Master Plan (1998)

From this table it can be derived that the majority of trips is still short. Of all trips shorter than 2.5 km 40% has been made by foot, the second important mode after cycling. When commuter trip distances can be reduced by sound urban planning and spatial policy, than the opportunity for more bicycle trips will occur. However, the trend is that the share of trips shorter than 2.5 km is less in 1995 compared to 1980, respectively 41% and 45%. Especially the share of longer trips (> 15 km) is growing.

During the fifties to seventies some developments which were mutually reinforcing each other (trends in spatial planning, growing car ownership, trends in transport planning and predominant cultural images) were detrimental for the use of the bicycle. After mid-seventy the situation has changed. The function of NMT has been re-valued; NMT has

been integrated in overall transport planning, though opinions between spatial planners, politicians and citizens about the best way to do it, may still differ.

In Table 5 purposes are presented for trips by foot and bicycle (in percentage) for the Netherlands. It shows that the distribution of bicycle trips over the various purposes, hardly differ from the total of all modes in general. However, trip characteristics per mode are quite different as has been argued before.

Table 5 Trip purposes by mode of transport in the Netherlands, 1998 (in %)

	Walking	Cycling	Total
<b>Commuting</b>	5	15	15
<b>Business trip</b>	5	2	5
<b>Social</b>	11	11	14
<b>Shopping</b>	25	26	23
<b>Education</b>	11	14	8
<b>Leisure</b>	10	12	12
<b>Get around</b>	16	3	4
<b>Other</b>	19	17	18
	100	100	100

Source: CBS the Netherlands, 1998.

In this chapter we won't go into much detail concerning the Dutch experiences and projects. Chapter 3 refers. Some basic information and lessons learnt from the Dutch Masterplan will be presented. Chapter 5 goes into more detail about the experiences in Delft, a Dutch city where a network planning approach has been pursued.

### 2.3 The NMT-user: a Prisoner of his mode? Captive vs Choice Modes

The Dutch experience shows that the share of bicycles/pedestrians in the trips made is relatively constant. Some changes between the distance classes can be observed. Many other countries, developing countries in particular, show an impressive decrease of NMT in the modal share. Evidence from these countries proves that cyclists and pedestrians hardly choose voluntarily for using the bicycle or going on foot<sup>5</sup>. For them there are no other options to choose from; they are the so called captive riders or walkers. People who do have options are deterred from using bicycles (or going on foot), by a lack of facilities for safe and convenient walking and cycling as well as by the "poverty" image NMT has. It suggests that users in the Netherlands will have different reasons for using NMT than those so-called captive riders and walkers in developing countries. That will consequently have an impact on the strategy to promote NMT. The Dutch choice for NMT is typically not an exclusive choice of mode, but an inclusive choice per trip. The Dutch transport system maintains parallel public infrastructures and services for walking, cycling, public transport and private car. The existence of vehicle choice and parallel infrastructure and services allows for sensible mode-chains, in particular the cycling-train and walking-bus chains. In the range of options the private car choice is still dominant.

This captive ridership in a wide number of countries also explains why men and women travel long distances on foot or bicycle. For example, in outer areas of Delhi, non-

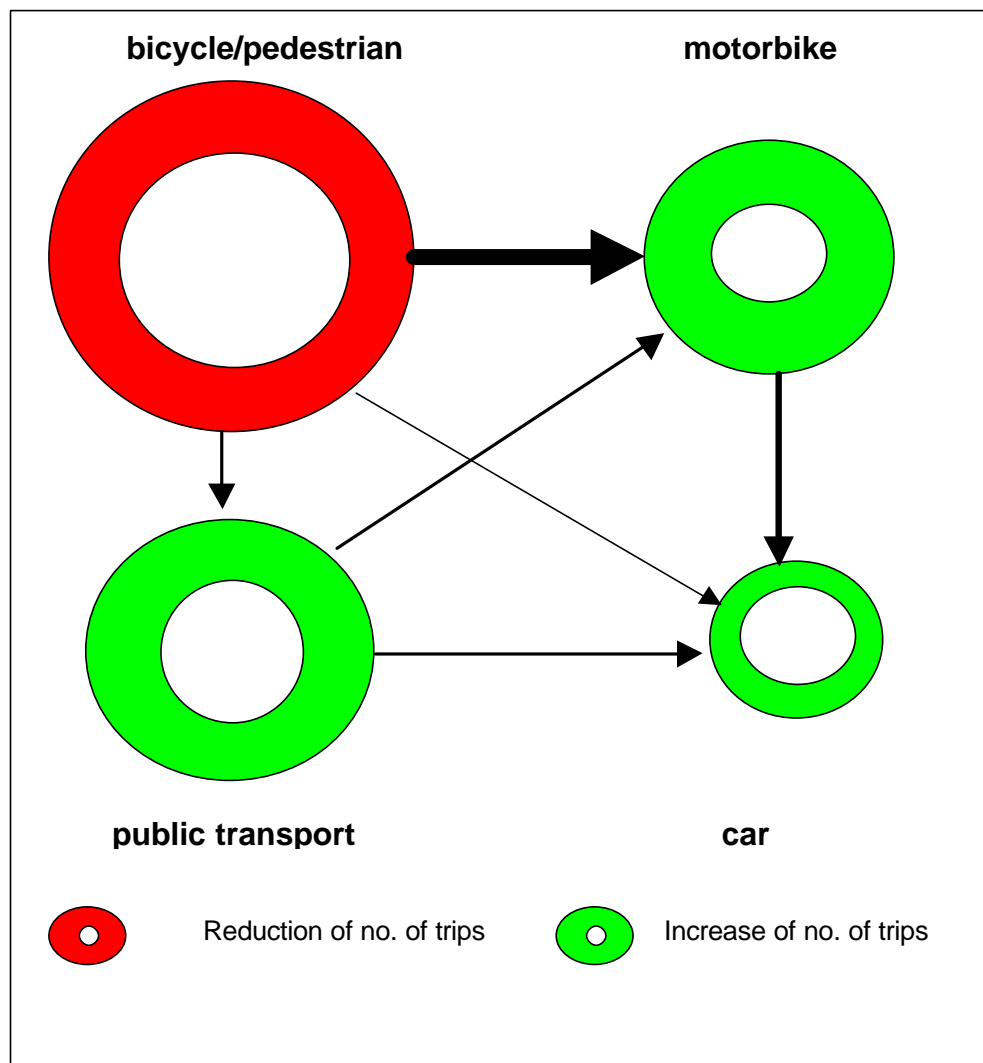
motorised vehicles and pedestrians are present on most intercity highways and travel long distances<sup>6</sup>.

The result of this finding is that in case of a dominant “captive ridership” one should primarily focus its interventions and policies on preventing these NMT-users to switch to another mode, than to focus on motivating non-NMT-users to walk or cycle. By providing facilities that increase safety, directness, speed and comfort one will attract new users as well.

### 2.4 Role of NMT at Different Stages of Development

The topic dealt with in section 2.3 is closely linked to the role of NMT at different stages of development. Economic development in a number of poor countries initially goes hand in hand with a decrease in NMT and an increase in car and motorbike ownership. Growth rates of the number of motorbikes in the last 10 years in Vietnam are astonishing. In Ganghzou bicycle trips are more and more replaced by car trips and public transport. A severe drawback in the economy of Nigeria in the late eighties had a significant impact on vehicle ownership and trips made by car. From the observed trends we can conclude that economic growth does not automatically lead to increased use of NMT in urban areas in developing countries, the reverse may be more likely.

Below we present two different scenarios of future transport development. In both cases we assume that no NMT-interventions are carried out.





above figure, we have elaborated on the Chinese or Vietnamese case. In these countries walking and cycling have been the major way to move around in the city until quite recently. Therefore the circle at the top left is biggest. The red ring means a reduction of the number of trips during the last few years has taken place. Without interventions, the process is likely to continue. Not only people choose voluntarily for a more “prestigious” means of transport, they are also more or less forced to. Trip distances become longer, roads are upgraded and even not allowed for cyclists, and NMT-users feel more and more endangered as safety is decreasing due to increased volume and speed of MT.

The green rings mean an increase in trips. The inner ring is the initial situation (let's assume 1995), the outer ring the situation in 10 years time from now. It is expected that the growth for the three other modes (public transport, car and motorbike) will come partly from the switch from pedestrians/bicycle to these three, and partly from the increase in mobility. Namely, people travel more than they used to do 10 years ago<sup>1</sup>.

From the figure one may derive that a road user will probably try to motorise his or her trips; once that is possible, the road user will choose for an individual one with which he can identify. The car can thus be assumed as the “highest” order of transport: motorised, highest status and non-public.

To some extent the same starting point and process can be observed in some African countries. There are differences: the importance of pedestrians is actually much higher compared to the bicycle; changes due to income increase will be from walking into cycling; therefore NMT use will be relatively stable (internal NMT changes); the role of motorbikes which are not very popular now won't change so much. Therefore, the increase is expected to be in public transport and private cars.

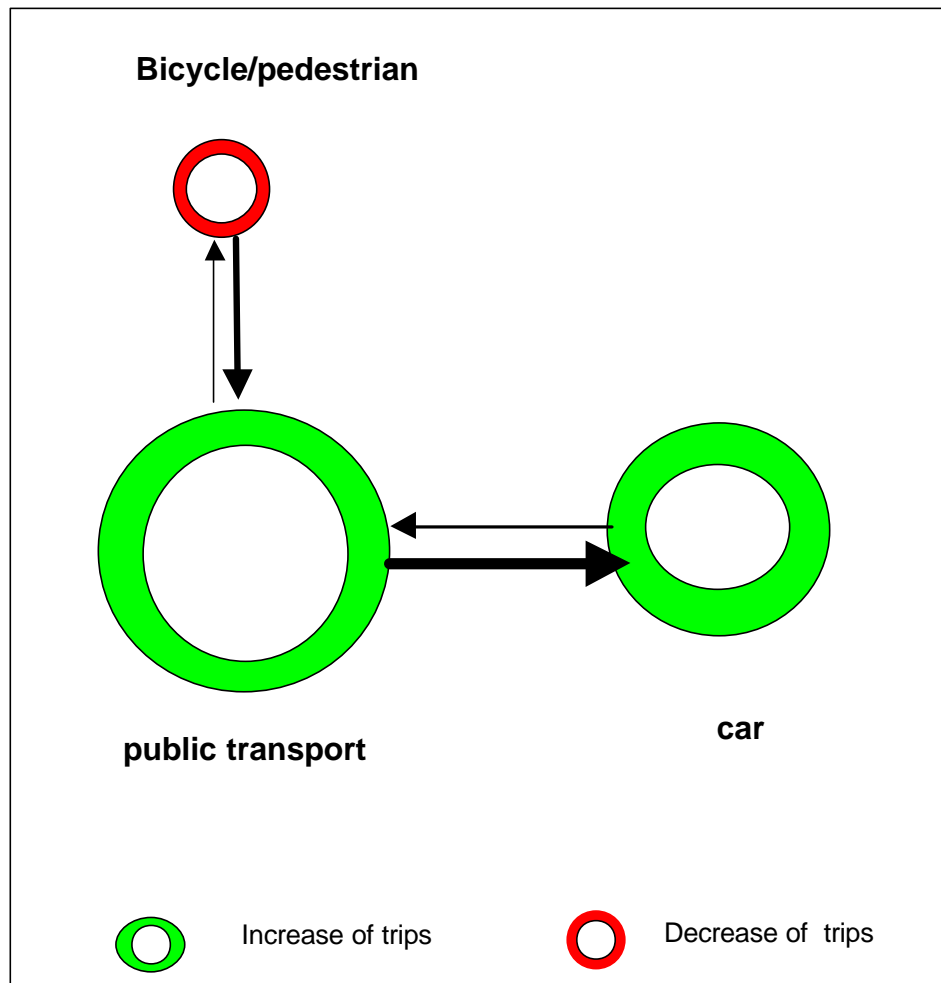
This scenario is actually quite comparable with the situation in the post-war Europe when a sudden decrease in NMT could be observed and the use of other modes increased due to similar reasons (which are not all explained here).

Below a figure is presented which represents a situation that can be found in countries of Latin America. It shows the absence of motorbikes and the minimal role of walking and cycling as a means of transport. Growth will be especially in trips per car and public transport.

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Godefrooij argues that an increase in travel time and trips is unlikely. Through time the number of trips and time spent on commuting per person is fairly constant (See G.Hupkes, *Gasgeven of afremmen, toekomstscenarios voor ons vervoerssysteem*, 1977). The only difference is that people will travel further, not more often or longer. Werner Brög states that 'market of trips is a closed market'. If so, than an increase in one mode of transport, should generate a decrease in another (generally, the number of trips by foot decreases). Godefrooij suggests that this also the case in Asia. 'Travel more' is only valid when we look at kilometre/person. The reason for this distinction is that it brings us to the real issue of transport systems: to enable people to be engaged in economic and social activities. One can improve the quality of the system (and so participation in activities) by enlarging the options of choosing the transport mode. A more or less forced extension of the trip generates more costs, but not necessarily more income.



The issue of non-motorised freight transport is not dealt with in these two figures due to lack of data. However, experts expect that without promotional activities (or without the removal of regulations that makes it difficult for cart riders to operate), this transport mode will disappear gradually. Interesting to see is the emergence of new, innovative non-motorised freight transport in congested cities in the USA and the Netherlands. However, it is still doubtful whether these bicycle couriers and recumbent freight bicycles can compensate for the decrease of the more “traditional” non-motorised freight transporters in developing countries.

In general, the above expected trends suggest that without an active policy to promote NMT, its overall share will decrease.

## 2.5 Social, Economic and Cultural Dimensions of NMT Use

The prevalence of NMT-use is very much related to social, economic and cultural environment, which are differing per area and stage of economic development. Below we will go into some more detail and conclude with a profile of the existing NMT-user. As section 2.2 about cycling in the Netherlands has shown us, the use of NMT varies over time, as does its user. This statement about the dynamics of NMT is valid for other countries as well.

### 2.5.1 The Socio-Economic background of NMT-users

As is stated in chapter 1, NMT is frequently associated with poverty. It remains the main means of transport for large poor sections of some of the very poor countries. These sections are often referred to as the captive user (see section 2.3). Actually, this picture is just partly correct. Namely, the share of NMT in kilometres as well as in number of trips is significant in some of the richest countries in the world (the Netherlands, Denmark, Germany, and Switzerland). Further, in some developing countries ownership of bicycles is highest in the middle-income strata. The poor are usually excluded from this means due to the lack of finances. A survey, carried out in 1996 reveals that a majority (54%) of bicycle users in Delhi (India) earns a family income of over 2000 Rps, indicating that bicycles are not just owned by the poor. Only 19% of the users earns less than 1500 Rps. A similar survey in Leon (Nicaragua) finds out that 89% of the users is relatively well off (based on housing conditions), and certainly doesn't belong to the poorest strata in society.

With respect to age, the NMT-share of each age-cohort correlates closely with its share in total mobility. This means that the age-cohort 25-35 shows the highest share of NMT-use; it is equally the most mobile age group. Data from Guangzhou, Delhi, Leon and Accra support this conclusion. It is author's impression however that in medium-sized cities in Vietnam, the age group 10 – 20 is of most importance. Nearly all secondary schoolchildren go to school on bike, since public transport is not appropriate. Motorbikes are taking over more and more the position of the bicycle as a means of transport for the age group 25 - 35.

### 2.5.2 NMT and its gender dimension

As can be found in all statistics, women are using far less the bicycle as means of transport in developing countries as men do. Figures from India (New Delhi), Ghana (Accra), Peru (Lima) and Nicaragua (Leon) show clearly that there is a strong gender bias in the use of the bicycle. Men's share is 100%, 99%, 84.6% and 90% of all users for the aforementioned cities. In Guangzhou (China) such a bias is not existing. Author's impression is that in Vietnam for instance the majority of cyclists is female (data is lacking). However, China and Vietnam are exceptions to the overall picture elsewhere. Nevertheless, these exceptions can help us in identifying the reasons for and ways to overcome the gender bias.<sup>2</sup>

Some reports refer to the social or moral fabric/construction of society in which a woman should stay at home, or should not go around in such an inelegant way. Though this might be a valid reason in some cases, in many others it is probably not. For instance, the first explanation (women should stay at home) conflicts with the finding that women's share in using public transport is generally much higher. The second explanation (the elegance excuse) is not consistent with the fact that these women often are engaged in "rough" jobs. In these cases it has probably more to do with intra-household decision-making processes (the battle about the bicycle is generally lost by the female members), lack of money to buy an additional bicycle, insecurity in certain areas and the design of available bicycles (unsuitable for female dresses).

Further, as shows the case in Vietnam and China, campaigns in the sixties and seventies to promote the use of bicycles by both men and women as part of people's ideological and economic liberation contributed vastly to the unbiased use. This shows that the present bias should not be taken for granted by policy makers.

Data from the field show the enormous potential of the bicycle for women, particularly the poorer ones. Data from Tanzania reveals that 90% of the volume transported by a household is carried on a woman's head. Health reports state that carrying heavy loads might result in cervical spondylosis and spinaldeformaties. As women carry out most of

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<sup>2</sup> In some West-European countries women are the predominant bicycle users. One of the reasons is that the family car is often used by the husband.

household transport, a higher rate of bicycle use could reduce their workload significantly and help to prevent some unhealthy effects of their work.

A study on transport services and its gender aspects in Lima (Peru) shows that this potential female demand for NMT will only be adequately served if services do consider social safety. The study shows women's valuation of attributes of transport services and infrastructure is different from that of men. Women rank the attribute "social safety" much higher than men. Below table refers.

Table 6 Valuation of attributes of transport infrastructure/services by gender

ranking	Women's valuation	ranking	Men's valuation
1	Social safety	1	Speed
2	Road safety	2	Road safety
3	Price	3	Organisation (schedules/routes)
4	Comfort	4	Single fare
5	Courteousy	5	Social safety
6	Hygiene	6	Courteousy
7	Organisation	7	Hygiene

Source: Gomez (2000)<sup>7</sup>

For recommendations to overcome the gender division in the use of NMT, we would like to refer to chapter 8.

### 2.5.3 A profile of the NMT user

The typical bicycle user in urban areas in developing countries is a man, in the age category of 25 and 35 and who is employed. His financial status allows him to buy or rent a bicycle. A motorbike or car is far beyond his income level. He prefers to take the bicycle instead of the bus, since it saves money and time. This profile of a "stereotype bicycle-user" can help us in designing interventions for the promotion of NMT. A profile of a typical pedestrian can not be given, since accurate data are missing. However, there are indications that walking is not such a gender-specific activity.

## 2.6 The user's and non-user's perspective and attitude towards NMT

It is only since quite recent that some attention is being paid to the needs of the population with respect to transport and mobility. The user-perspective was hardly the basis for transportation planning. In the best scenario traffic counts formed the basis of the huge investments in urban infrastructure. Usually it was not. To solve the mobility needs of the poor, emphasis had been concentrated on public transport. A supply-driven approach rather than a demand driven one had been pursued. Due to limited success of the strategy followed, a more qualitative approach was pursued. User surveys were conducted. An example of this is the survey carried out in 5 different locations in the world (Accra, Delhi, Guangzhou, Leon and Lima) in 1996<sup>8</sup>. Travel behaviour as such and characteristics of the trip formed the basis of a study. Below, major key findings are presented. They give some ideas about the perception of users of NMT (bicycles in particular) and of users of public transport (in the case of Leon).

The study in Nicaragua (Leon) shows that 82% of the cyclists interviewed prefers the bicycle to public transport because it is more affordable. A second reason is that the bicycle is quicker and more flexible. While public transport is bound to certain routes, with a bicycle you can get nearly everywhere. A minority of the users sees the bicycle as a means of sports and exercise.

Asked about whether they would switch from bicycle to a motorbike if possible, a vast majority of cyclists stated they would not: 84% said to prefer to continue cycling due to the low costs (50%) and to its safety.

A survey in Accra (Ghana) accrues similar more or less results; 42% of NMT-users consider the low costs involved as the most important reason to use a bicycle. The time-factor is mentioned by 36%, and its flexibility by another 8%. If compared with other means of transport, the bus for instance, respondents actually preferred the bicycle because of its costs (98%), speed (96%) and its reliability (94%).

A major difference between Nicaragua and Accra is that in Accra 65% of the cyclists said to change from bicycle to motorbike if the situation would allow it (in Leon only 16% would change). Major reasons for not changing are 1) costs (39%), 2) time-saving on short tracks (13%) and 3) flexibility (14%).

In Lima (N=300) the results show that 70% of the respondents finds that a bicycle is fast, 11% that it is comfortable and 7% that it is safer than walking when asked to mention the most important reason for using the bicycle.

Asked for their preference over the bus, 55% of the respondents mentioned the lower costs; Another 23% finds speed a determining factor to choose for the bicycle. For another 15% its comfort is the main reason. The following table summarises the findings.

Table 7 Attitude and assessment of NMT-users (%)

	Most important reason for choosing bicycle (in %)			Most important reasons or preference of bicycle over bus (in %) <sup>#</sup>		
	Leon	Lima	Accra	Leon	Lima	Accra
Costs	19		42	82	55	98
Speed	31	70	36		23	96
Flexibility			8		4	
Comfort		11			15	51
Reliability						94
Others			14			

<sup>#</sup> The interviewee was allowed to mention more than one "most important" reason. Therefore the columns don't count up to 100%.

From these findings we can derive that environmental issues are hardly mentioned as a reason for using NMT. Interestingly, the survey in Arequipa tells us that 89% of all MT and NMT-users interviewed said to consider the environmental problem due to urban transport as serious. Zuniga<sup>1</sup> records that 25% agrees that urban air pollution is one of the most important problems, followed by noise (21%), traffic accidents (20%) and congestion (15%). But such visions and views have commonly not so much impact on individual mode-choice behaviour. Day to day choices are mainly based on practical considerations. This knowledge should have a bearing on the policies to promote NMT.

The surveys in Lima and Leon give some insight why people are not using bicycles (Table 8). In this case the respondents are users of public transport. Below you will find the major findings. Surprisingly, most factors mentioned coincide with that of NMT-users.

Table 8 Assessment of cycling in two cities by Non-NMT users (%)

Positive factors about cycling (Leon)		Negative factors about cycling		
			(Leon)	(Arequipa)
Costs	33	Chance of getting accident	45	35
Speed and mobility	27	Risk of theft and of assaults	11	25
Comfort	7	High costs (taxes and high spare parts)	10	
Health/exercise and pleasure	16	Lack of respecting traffic laws	15	
		Lack of cycle paths		20
		Destination too far		10
		Steep slopes		5

In their synthesis report<sup>7</sup>, the authors conclude that in these 5 cities where the studies have been carried out, the bicycle is considered as a sustainable mode of transport. However, bicycles are perceived as hampering the smooth flow of motorised vehicles and contribute little to mobility in the city. Cycling has a low status in most cities and is regarded in some as a vehicle for men only.

## 2.7 Framework for understanding NMT use

In this chapter attention has been paid to factors that influence NMT-use and ownership of bicycles in particular. A profile has been drawn up for a cyclist and stakeholders that might influence the development of NMT are presented. In this section we will present a framework for better understanding NMT use. The framework therefor gives us insight in which environments or fields we have to make interventions to foster NMT. Figure 3 shows a schematic framework that can be derived from the 5 country study carried out by I-ce.

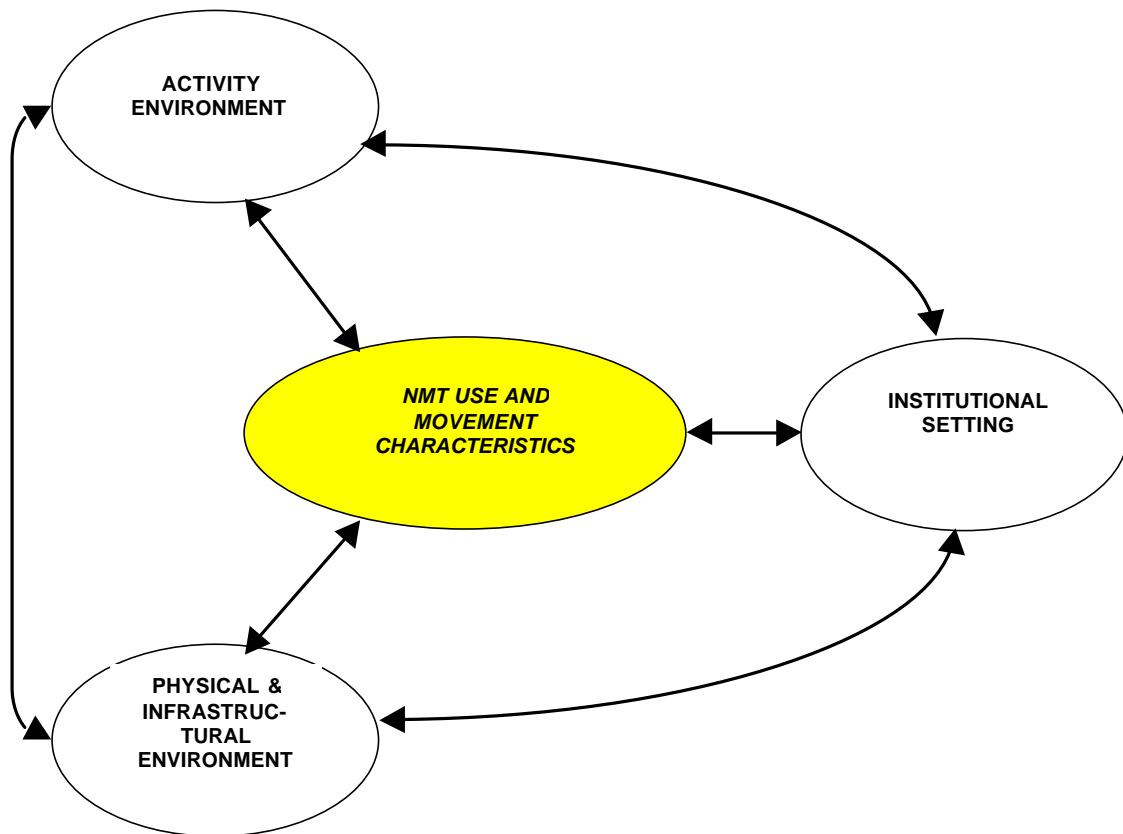


Figure 3 NMT use and movement characteristics and its influencing environments

The circle with trip characteristics and movements is actually the overall denominator for NMT trip lengths and travel time, purpose of trip, modal share, ownership of bicycle, theft and safety. All this will be influenced by the three environments. Hereunder the three environments are elaborated.

**The activity environment** consists of factors which determine whether and how a trip is made. Basic questions are then:

1. In which activities do I want to participate?
2. How can I get there (which options do I have)?

The answers are dependent on the socio-economic conditions (income per capita, employment etc.); land-use patterns and density; demographic background (age profile); cultural values which influence the status of walking and cycling and finally the awareness of NMT-benefits.

The comparative study shows that despite similar socio-economic characteristics of its populations, large differences exist in the socio-economic background of bicycle users and trip purpose in the five cities. Differences in building densities and spatial patterns, in bicycle infrastructure, bicycle industry, and institutional support are due to that. A high density of development (population and built environment) like in Chinese cities, creates

a favourable condition for NMT use, since travel distances are generally short. Average travel distance in big cities of over 2 million inhabitants in China is around 3.3 kilometre. The study indicates that population density correlates (positively) with bicycle use. For walking a similar correlation is presumed.

**The infrastructure support environment** consists of factors that enable people to walk or cycle. It includes a NMT-network with facilities which can be safely and efficiently used; a manufacturing and retail industry that influences the availability and price of bicycles; and other facilities such as at the workplace, stations, public transport etc, not necessarily part of a NMT-network. The quality of these facilities is of all importance to their use. In chapter 5 we will introduce the five main criteria for assessing their quality.

The comparative country study shows that in China the government encourages the design and construction of a three-tier grade separated road section where a physical division between cars and bicycles is made. In Guangzhou specific pedestrian and cycle facilities are constructed to promote NMT. In the case of Lima and Leon, both cities with World Bank supported infrastructure investments, the modal share of NMT (cycling) has increased or stabilised, whereas in Delhi (without investments for bicycle promotion) their share went down from 18% in 1981 to 6% in 1994.

**The institutional setting** includes people, policy, laws and regulations that might foster (or hinder) the use and purpose of NMT. It comprises of a policy and funds for bicycle and walking infrastructure and facilities, a subsidy and/or credit programme for using NMT, active promotion campaigns etc. Further, it comprises people, like politicians, planners and transport engineers (supply side) as well as advocacy groups, NMT-representatives and scientists on the other. The attitude and perspective of these groups, as well as their own capacity and that of their institution is a decisive factor as well that influences use and purpose of NMT.

The supportive credit and financial incentives programme in China did many people make use of NMT and buy a bicycle. In many other cases, there is a strong institutional bias against NMT. Expertise for planning and design of NMT infrastructure is low; taxes on imports are high; special fees for bicycle ownership (Ghana and Leon) are existing and stronger looked after than the fees for car ownership.

Based on this model and its explorative power, Tiwari and Saraf<sup>9</sup> stated that the institutional support is the key environment since it influences and shapes the other two environments as well.

This model focuses on the use of NMT, especially the bicycle. Actually, one can easily justify that the model applies for all transport modes; a person will, once a decision for moving has been made assess what means of transport is available and suits him/her best for that particular trip. This decision-making will be based on factors as mentioned in the three surrounding circles. This way it becomes clear why NMT is and should be treated as an integral part of traffic and transport policy.

## 2.8 Conclusion

The important conclusion is that the prevalence of NMT is related to various factors. Individual characteristics or the ones under the “activity” environment play one important role. However, as has been shown in this chapter, the institutional context as well as the infrastructure one, fulfils another important role to understand NMT use and function. The weight of these factors varies geographically and in time. In many countries tendencies point into a direction of more motorised transport in future at the cost of NMT. This finding urges policy makers to take action. A decline in popularity should not be taken as granted as has the Dutch case shown. In the following chapter we will therefore go into more detail about the institutional context, how that might influence NMT-use. A focus will be on the experiences gained in the Netherlands.



## **CHAPTER 3 INSTITUTIONAL AND POLICY ARRANGEMENTS**

### **3.1 Introduction**

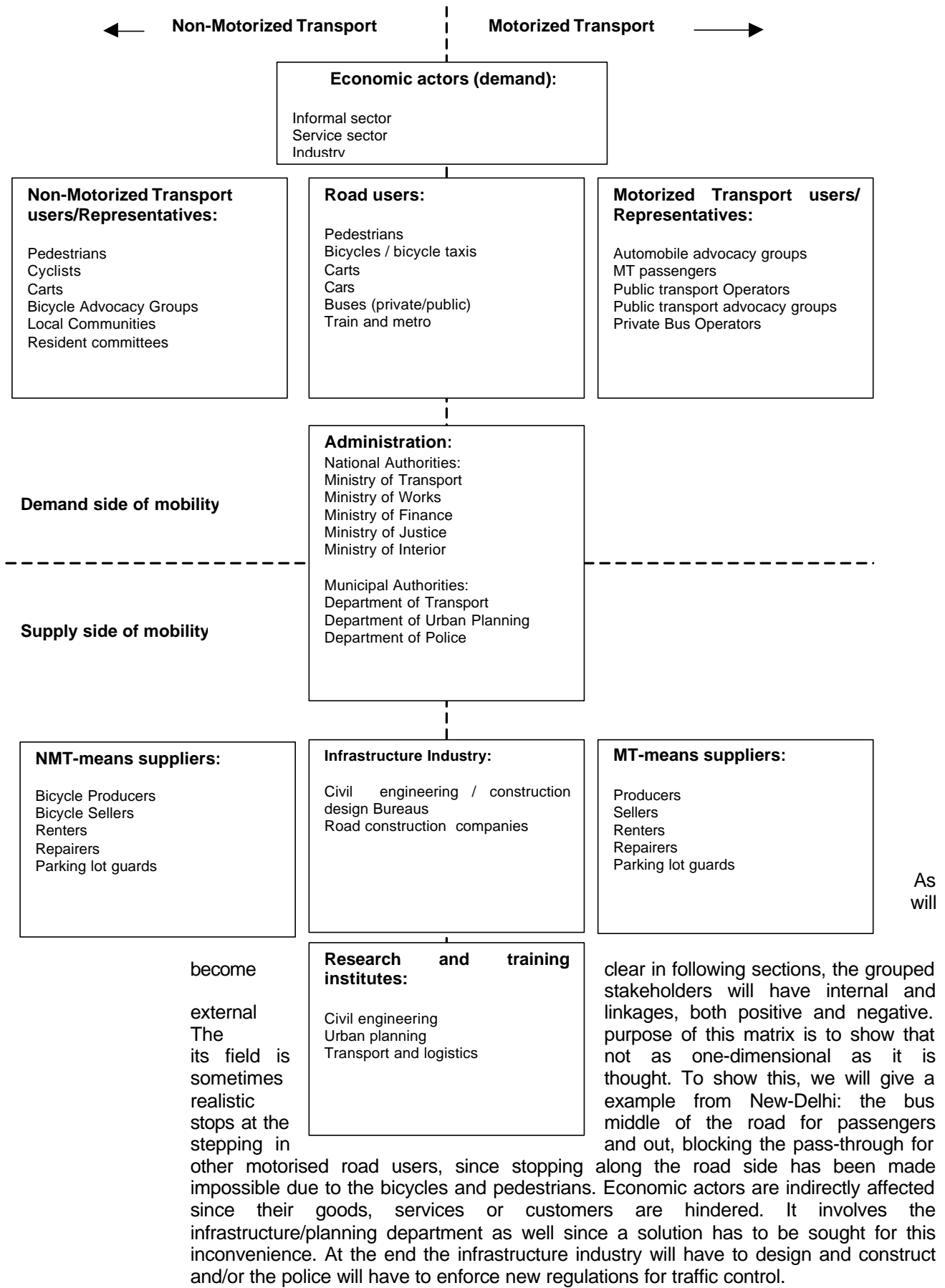
In this chapter we will focus on the institutional aspects of transport, NMT in particular. It is useful to have a good overview of what the actors are in the field of policy, planning and implementation of interventions. Therefore we open this chapter with a section on stakeholders in NMT. In section 3.3 we will present a model - the interaction triangle. We continue with an extensive description of the Dutch Masterplan bicycle and will highlight the lessons learned. The final sections will be about financing mechanism for NMT investments and capacity building.

### **3.2 An overview of all relevant stakeholders in NMT**

In this section an overview will be presented of all relevant stakeholders in NMT. Before we will elaborate on this, it is useful to define the term as it is commonly used:

“A stakeholder is any person, group or institution which has an important (be it direct or indirect) interest in an activity or issue, whether in terms of affecting it or by being affected”.

Stakeholders in NMT are all road-users (pedestrians, cyclists, tri-cyclists, carts, cars and buses, trains and metro) as well as their representatives (advocacy groups, passengers, operators and local communities). Furthermore, we can identify administrative agencies (ministries of transport, works, finance, and law and their local representative departments), research and training institutes, and finally the transport and infrastructure industry. Economic actors, such as employers, shop-keepers or informal industries do express a demand for NMT and can be called indirect stakeholders. Below these stakeholders are presented systematically in a matrix. A division that has been made is based on two criteria: demand or supply, motorised and non-motorised. In case such a clear-cut division could not be made, the stakeholder-group is placed on the dividing line.



One major stakeholder, i.e. the Donor community (World Bank, Bilateral Donor, NGO), has been excluded for reasons of simplicity. Actually, since they operate by or through one of the others, they are left out.

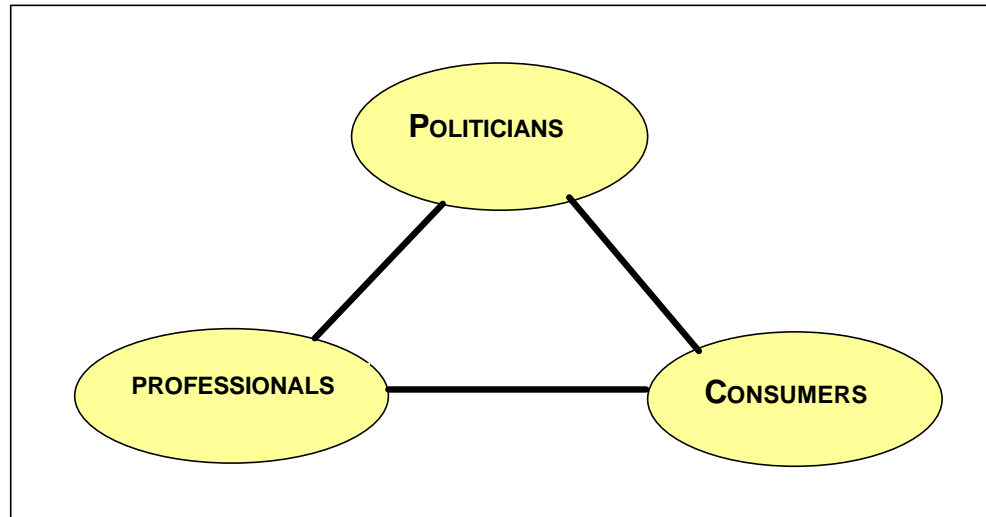
Rijnsburger<sup>10</sup>, a Dutch policy-expert working on the SSATP, identified various stakeholders and their role (and interventions as well as instruments) in the promotion of NMT. Table below refers.

Table 9 Actors and their responsibilities

Level of intervention	Instruments	Requirements
Direct intervention by central or local government	Investment in infrastructure and facilities Legislation Promotion	Capital Expertise By-laws enforcement Credibility
Central government to stimulate initiatives within own responsibilities of lower governments and NGO's	Subsidising local investments in cycling infrastructure and facilities  Financing research and demonstration projects  Promotion Legislation	Capital Criteria  Capital Expertise Credibility By-laws enforcement
Development agency/donor to support government policy development.	Facilitating policy development  Facilitating implementation	Capital Expertise  Capital Expertise
NGO to initiate changes in government policy.	Formulation of policy document and action plan  Lobbying and campaigning Street action	Finance Expertise Contacts Grass root basis

### 3.3 Institutions

Above the issue of stakeholders has been addressed. Various divisions between the parties of interest have been discussed. Usually a pragmatic approach is helpful, i.e. demand vs supply, users vs non-users. Before we will continue with a series of case studies in which a whole range of stakeholders will enter the stage, an abstraction will be presented, the so-called "interaction triangle"<sup>11</sup>.



The three circles show the components of the interaction triangle. The “politician” circle represents urban/local political authorities and administrators. They are elected person who are in charge of making final decisions.

The consumer circle includes inhabitants, cyclists, other road users etc whose interests and aspirations should be expressed in cycle projects undertaken. They are the ones who know the day-to-day problems in urban transport. Information and suggestions from the ‘consumers’ is therefore of imminent importance for policy makers and transport providers. They are the prime experts when it comes to identify problems that need to be solved. Often from this circle first initiatives are taken to set a process in motion to get attention for NMT issues.

The professional circle consists of the experts who, on a paid basis, investigate and analyse the situation, generate options for solutions, and prepare the political decision-making; this circle includes designers and city-engineers as well.

It is the Dutch experience that partnerships should be created to ensure sustainable and successful plans. Leaving out one of the circles in the process may result in weak solutions and ongoing disputes. The triangle offers the opportunity that conflicts between two circles might be solved by the third, intermediary party. As a result of this synergy of circles a climate of innovation can emerge and a process of decentralised, multi-stakeholder decision making can become possible. However, lack of consensus and politically feasible solutions may result in a lack of political willingness, which in turn might affect funding and resource allocation.

### 3.4 National and Local Planning for Non-Motorised Transport

Changes in city traffic and transport in which cycling is (positively) involved, are often initiated and carried by individuals, such as activists, professionals and civil servants or politicians. Upscaling to higher levels is then the necessary approach for integration of cycling in urban and national policies, resource allocation for infrastructure, and for changing the perceptions of citizens with respect to status and economic benefits. For upscaling one will rely on the stakeholders that were described in section 3.3. The Netherlands has been through such a process as the following sections will show. The Dutch national cycling plan, the Bicycle Masterplan, will be described in detail.

#### 3.4.1 Dutch bicycle policy in the 1990's: the Bicycle Master Plan

This section will rather intensively review the development of the Dutch Bicycle Master Plan, its framework, major strategy and objectives. We will briefly mention the sort of activities that has been carried out and the major results.

As was mentioned before, in the 1970s a trend reversal took place in the role of cycling in Holland. Local advocacy groups, parties and neighbourhood groups, in Amsterdam and Eindhoven for instance made plans for improving the traffic liveability and/or enhancing the cycle network in the city. Due to several reasons the political environment at national level got interested in an increased role of "slow traffic modes". The reasons were: 1) prior investments in road construction could not solve the problems in mobility, 2) an increasing budget deficit and 3) increasing external effects related to car use.

In fact, in the late seventies the essential objectives for the later national bicycle plan were laid down in various policy documents; they aimed at:

- Limiting growth in car use
- Improving flow of public transport
- Stringent parking policy
- Constructing safe and attractive bicycle routes.

Nevertheless, it took 15 years before the preparation started for the establishment of the National Bicycle Master Plan in 1990. A project manager was assigned and a project group from several divisions and levels of the Ministry of Transport was established. Besides, a sounding board was set up, made up with representatives of interest groups (bicycle industry, bicycle advocacy groups, Dutch Traffic safety Organisation, Association of Road Users) and authorities (provinces and municipalities). After one year, the project group could present the Bicycle Master Plan Policy Document that was approved one year later in 1992 by a parliamentary commission for transport.

### 3.4.2 Framework

The Dutch Bicycle Masterplan was an elaboration of one element ('track') of the 'Structured Scheme for Traffic and Transport', a long term transport strategy for the Netherlands (1989). It set a number of targets for 2010, of which the most important was to limit the expected growth of car use of 70% to a growth of 'only' 35%, thus cutting the envisaged growth by 50%. To achieve this, a strategy was chosen comprising 5 components:

#### **Component 1: Dealing with the source.**

This means clean and efficient vehicles, limiting land use for infrastructure and limiting vehicle access to towns and areas of natural interest.

#### **Component 2: Reducing and managing mobility.**

This requires shorter distances between places where people live, work, shop and entertain.

#### **Component 3: Improving the alternatives to the car.**

This includes bicycles, public transport as well as car-pooling.

#### **Component 4: Providing selective accessibility by road.**

Not all places should be totally accessible to all modes of transport.

#### **Component 5: Capacity building.**

This comprises communication, research, training, government co-operation and finance.

Objectives were formulated and included issues as quality of life, accessibility, environment, safety and energy. Traffic fatalities had to go down with 50%, traffic injuries by 40%, and car use emission levels by 75% (nitrogen oxide) and 10% (hydrocarbon and carbon dioxide) by the year 2010 (base year 1986).

### 3.4.3 Strategy

The approach taken by the Government was one of decentralisation **in policy execution**. An important role has been laid down for parties other than the central government, as provinces and municipalities.

Further, it pursued an **integral policy approach** for curbing car traffic. The project group elaborated on this and aimed not so much at just increased use of bicycles but on solving traffic and transport problems and/or restricting car use. It found that bicycle policy must be seen as an inextricable part of traffic and transport policy as a whole, where cycling is a transport mode amidst other modes. A statement as: choose and facilitate the transport mode that is most efficient for a specific trip is therefore not surprising and shows its integral vision. Spatial planning (the compact city) has to be duly considered since short trip distances increase the chance of bicycle use.

The overall objective of the Ministry of Transport with respect to bicycle policy was:

*“Promoting bicycle use while simultaneously increasing bicycle safety and appeal”*

This objective has been operationalised into 5 so called spearheads and targets. Below, the spearheads and targets are given (

Figure 4). It was recognised that a two-fold strategy should be followed: a long-term and a short-term in which positive direct effects are to be produced. This entails the removal of cycling bottlenecks, providing examples and to speed up the plans under preparation and execution. Long term measures included the innovation development, promotion campaigns, legislation and capacity building.

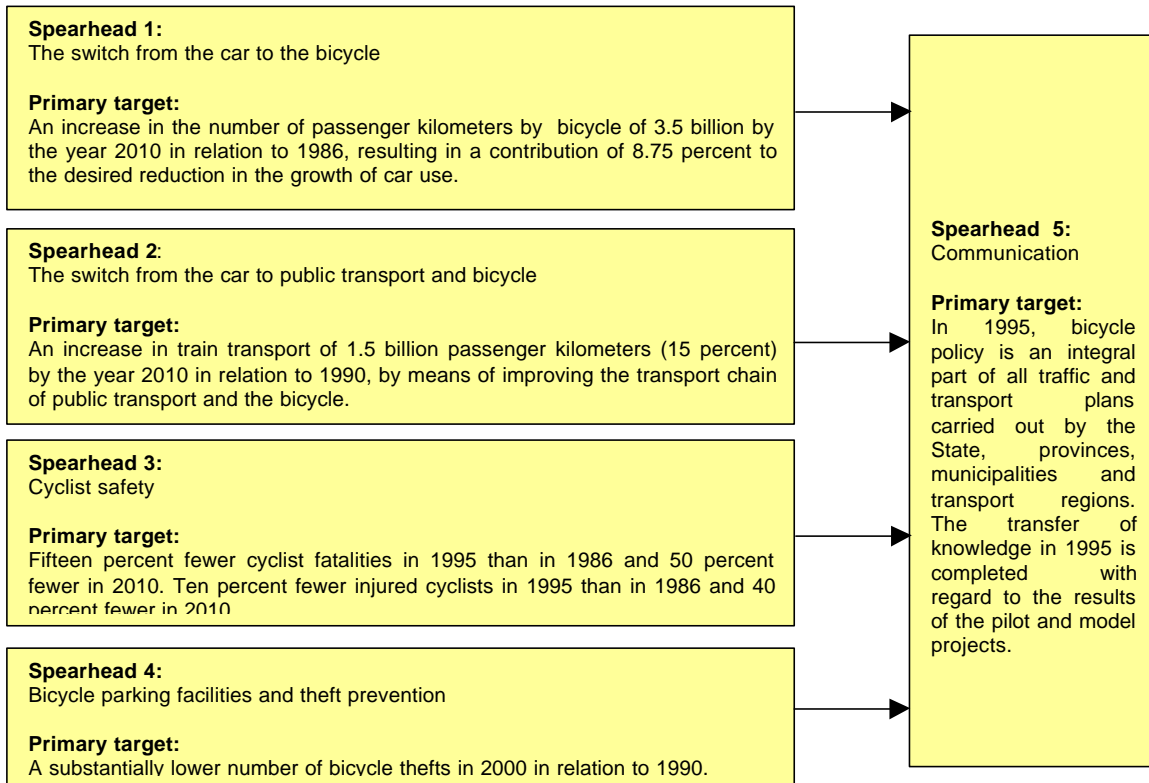
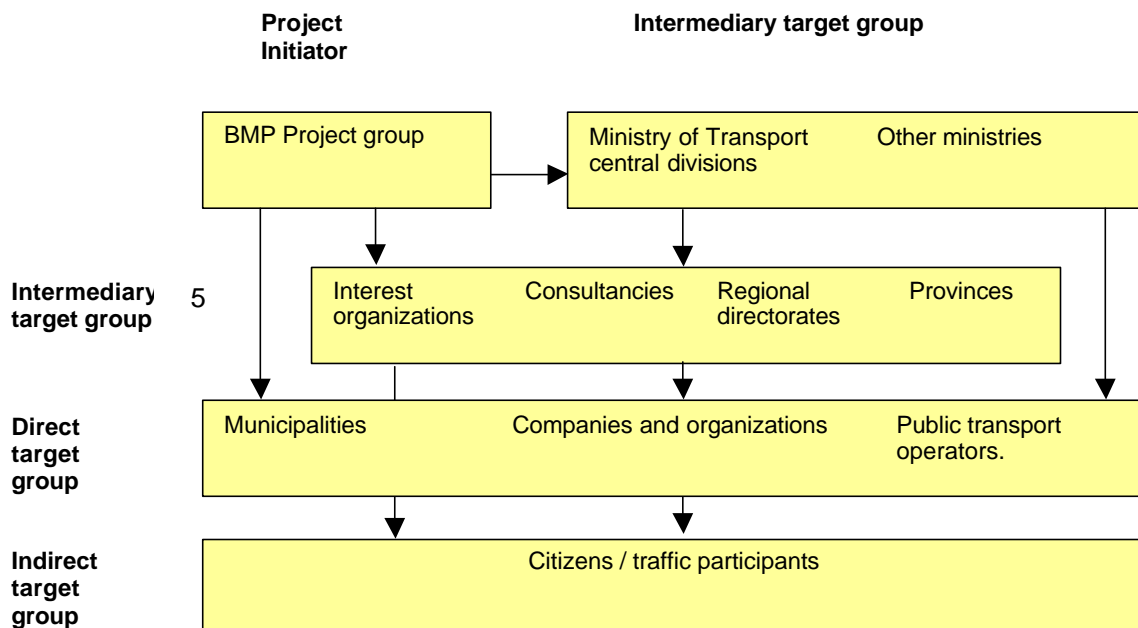


Figure 4 The five spearheads of Dutch bicycle policy

As has been mentioned before, decentralisation was a major starting point when it comes to policy execution. Therefore the main task the national project group saw for itself is one of enabling stakeholders (authorities, public transport operators and enterprises) to embed bicycle policy in their policy plans and to execute activity programmes, by means of providing knowledge, arguments, instruments and finances.

### 3.4.4 Target groups

The diagram below shows the main target groups during the implementation of BMP. The importance of each group is and was not fixed and changed over the period of the programme. For instance, whereas the provinces played a minor role in the beginning, during the final stage (when the decentralised approach took off the road) their role as co-financer and policy / programme developer became more important.



Figure

### Target groups in the BMP

The figure suggests that the Bicycle Master Plan is rather top-down. In fact, this has not been the case, although some representatives of bicycle user groups have a different opinion. In reality, there were opportunities to influence decision-making at higher levels, and to give and receive feedback.

The municipalities formed the most important target group by far. They are in the best position to pursue / endorse effective bicycle policy. At the end of the row, the citizens and traffic participants are positioned. They form the indirect target group for the BMP's activities.

#### 3.4.5 Implementation strategy

It was realised that for reaching the objectives, one is heavily dependent on other, related policies, such as the extent to which car use is facilitated, public transport provided and spatial planning of cities carried out. A very concrete example of an unintended side-effect of the policies of the Ministry of Education was the effect of free students passes for public transport: these free passes resulted in a dramatic drop in bicycle use in university cities.

The State's influence on decisions made at local level concerning traffic policy is limited. Therefore, extensive guidance and capacity building of intermediaries appeared crucial for achieving successes.

To avoid funding of parallel programmes the budget for research, pilot and model projects was not decentralised.

In making organisations more part of the process and so to increase capacity as well as their commitment to promote bicycle use, the project aimed at co-implementation with intended target groups.

It selected a whole range of relatively small projects. It was thought that a wide range of projects would spin off more than a few big ones. This again is more in line with the BMP strategy to enable other stakeholders, to act as a catalyst and to get bicycling on the agenda.

#### 3.4.6 Communication

Communication turns out to be one of the most crucial conditions for achieving the expected, medium- and long term impact. Not communication for its own good, but for disseminating knowledge, innovations and arguments in order to sensitise, involve and activate other stakeholders, ministries, provinces, private sector, public transport operators, municipalities etc. As can be seen from

there was no direct communication between the project team and the road users. There was a deliberate choice to concentrate the communication on intermediary target groups. No mass media campaigns were executed within the framework of the Bicycle Masterplan.

To make sure that the message comes across, the project group has used various packages, media and intermediaries.

#### 3.4.7 Evaluation

When evaluating the BMP one can focus on three different sets of output:

- First, one might focus on the direct outcomes of the projects that have been carried out. In that case one shall pay attention to the development of knowledge, arguments and instruments (3.4.7.1).



- Second, one might focus on the internalisation of the results of the projects in policy and plans of the target groups (3.4.7.2).
- Third, one might look at the effects that has been reached and for which one have developed quantitative verifiable indicators (3.4.7.3).

#### 3.4.7.1 Evaluation of the project results

From the beginning the project team had chosen for a large number of small, diverse projects, rather than to concentrate on a few bigger ones. The risk of failures was accepted because it was recognized that failures can be very instructive as well. This is especially true for experiments and pilot projects. But it is also fair to say that the large number of projects that needed to be managed complicated the work of the project team.

The results of the **31 research projects** were generally positive. The majority of projects provided a clear-cut and practical response to the research questions.

The results of the **41 pilot and model projects** were less positive. Just half of them were successful. The reason for this rather low rate is caused by the fact that these projects were relatively innovative trials. Further, the team should have paid more attention to the following:

- Hypotheses and theories which are at the basis of the project, should be discussed critically. It should be clear whether verification of falsification of such hypotheses are in itself enough justification for the project.
- Much effort should be put into a smooth co-operation with project partners.
- A leading project team should allow for project partners to feel ownership for the project, and get the opportunity to claim positive results.

Nevertheless, the BMP-evaluation report states that the more intangible results, like motivating and convincing target groups, were far more positive.

The results of the **18 instrument development projects** (with a strong technical emphasis) are mixed. Due to institutional problems with respect to the execution of this component, success was limited. However, the design manual for better bicycle facilities and infrastructure has been positively received by professionals (Sign up for the bike (1993)) and was regarded as one of the most important outputs of the project. This publication marks the change-over of provision for cycling as a matter of trial and error and common sense to a well based part of professional transport planning.

Twenty-two projects were carried in the **field of communication**. They were believed to be successful.

#### 3.4.7.2 Evaluation of the internalisation of the results in policy of target group

##### At ministerial level

Again, the results are rather difficult to quantify. One might argue that the project group was overoptimistic about the participation and motivation of other stakeholders and therefore in some cases failed. Further, it turned out to be too laborious and complex to involve all stakeholders. The strategy therefore was changed in order to focus on fewer issues. Through a shift at national policy level with respect to transport, big infrastructure projects and roadway network received more attention at the cost of a/o. the bicycle. However, three definite positive issues can be mentioned:

1. Bicycles are taken into account in the implementation programme for sustainable safe traffic infrastructure.
2. Bicycles received increased attention with regards to parking policy and transport management at companies.
3. Action is now on the way for improving parking facilities at railway stations and bus stops.

### At municipal level

A research on the development of the intensity of bicycle policy in nineteen municipalities shows that between 1990 and 1996:

1. Cycling received more attention in policy in 16 of 19 municipalities under survey;
2. Policy shifted from resolving bottlenecks for bicyclists to a more comprehensive approach paying (some) attention to all BMP spearheads;
3. There is a growing (but yet small) recognition that direct measures to restrain car use, will be needed.

In 17 of the 19 municipalities under survey, a bicycle plan was developed. In 13 cases the plan was considered to be excellent due to scope, programme and planned financial support. The survey indicates furthermore that there are primarily two factors that will foster the intensification of bicycle policy:

1. Local traffic problems and perception of it.
2. Political will and commitment depending on vision and courage of the councillors concerned.

### At company level

The use of bicycles has been adopted in nearly all company transport plans. However, the number of companies with such a transport plan is still limited. The success can also be derived from the fact that more than 20,000 copies of the brochure "working with the bicycle" were requested by companies. Regarding to concrete results, a growth of employees using the bike, one should be less positive. Though a growth in cycling in work-home traffic can be observed, the growth is less than expected.

#### 3.4.7.3 Evaluation based on the criteria formulated under the spearheads

#### Increase in bicycle use (spearhead 1)

Since citizens or traffic participants haven't been a direct target group on which the BMP focused, it is hard to state and evaluate what the effect of the programme has been on bicycle use. However, during the BMP-life time the bicycle has become a more appropriate alternative to the car. A clear increase in appreciation/valuation of the bicycle combined with public transport for work and that of carpooling as an alternative to car use come to the fore in the following table.

Table 10 Intended changes in behaviour by motorists in the event of driving less (in %)

	1993	1996
Bicycle for short distances	71	73
Public transport for medium distances	21	23
Train for longer distances	30	32
Bicycle combined with public transport (commuting)	26	34
Carpooling	37	45
Live closer to work	10	11

Source: *Verkeer en Waterstaat, 1998*.

Although these figures do not relate directly to actual behaviour, the shift in expressed intentions do suggest that cycling is more accepted as a feasible alternative than before.

**Switch from car to public transport and bicycle (spearhead 2):**

Again, it lacks data to show whether there has been a significant change in the multi-modal transport share. However, public transport operators have improved the facilities for parking bicycles. At a number of places, parking facilities are built for cyclists to park their bikes at bus stops (see under spearhead 4).

**Cyclist's safety (spearhead 3):**

Data shows that the targets for reducing the number of fatalities and hospitalised cycle victims are met for 1995. It is likely that the targets set for 2010 will be achieved. Table 11 refers.

Table 11 Number of cycle victims from 1980 to 2010 (expected)

	Cyclist fatalities	Hospitalised cyclists
1980	426	4,199
1986 (base year)	312	3,419
1990	304	3,277
1995	267	2,499
Target 1995 (reduction 15% and 10%)	265	3,080
Target 2010 (reduction 50% and 40%)	155	2,050

Source: *Institute for Road Safety (SWOV) 1999.*

#### **Bicycle parking facilities and theft prevention (spearhead 4):**

As stated before, significant progress has been made in efforts to improve parking facilities for bikes at stations, bus stops, offices and public buildings. The capacity of guarded parking lots has doubled since 1990, though its share is just 2% of all bicycles parked. However, the target of reduced theft rates won't be reached. The situation is more or less stable at a 600 to 700,000 thefts per year. On the other hand, these numbers are still less than the expected 900.000 theft cases, with which experts in the early nineties counted. However, reliable data on theft cases is a problem, since not all thefts are reported to the police. Remarkably, theft is less than before considered as a reason not to go by bicycle. Still, research shows that theft is often the reason for not having a bike, or having a very affordable one.

Unfortunately, there seems to be a positive correlation between a good bicycle policy, bicycle use and theft. The more people start to ride bicycle, the more opportunities are created for thieves to steal a bike and the bigger the potential demand for a stolen bike will be. It takes quite much integral effort as the Dutch case shows to battle this complex issue.

All spearheads as presented before depend for their success on a wide range of actors and policies. It shows once more that bicycling policy should be part of an **integrated and consistent traffic and transport policy**. Achieving substantial results is therefore a laborious and difficult task. Conditions for success are often beyond the immediate control of a single party. For instance, to reduce trip distance and so to increase the likelihood that people switch to a bike one should especially focus on spatial planning. To reduce theft of bicycles, success is also dependent on the policy of the police and judicial authorities. We therefore refer back to the model presented in section 2.7, pointing out that travel behaviour and NMT-use is the outcome of a complex social and institutional process.

#### **Integration**

Nevertheless, one may conclude that bicycle policy is now embedded in government and public transport operator policy. The capacity building approach, i.e. support to target-groups in the sense of distributing factual knowledge and of instruments developed has resulted in a lasting impression.

#### **3.4.8 Is the Dutch Masterplan a blue print for a good bicycle policy?**

There are about 10 countries that have formulated a national bicycle plan; most of these countries are European. A masterplan for the bicycle as has been developed in the Netherlands and England is unique. Recently, a bicycle plan has been formulated in South Africa, the Shova Lula (easy rider). Bogota and Delhi have developed a greater-city NMT-plan.

The author argues that a national masterplan, like the one from the Netherlands, can be relevant and suitable for developing countries as well. The question then is: is the Dutch masterplan a suitable blue-print for promoting NMT? The answer to this question is of course negative. Actually, the Dutch Masterplan is not very prescriptive and thus not useful as a blue-print; the Dutch Masterplan is the contrary; it enables the stakeholders to become involved in actual local policy and plan-making and motivates them to take their own responsibility. It defines some future goals and directions. Such an approach, without prescribing which specific measure should be carried out, is realistic and useful.

A distinction between the levels of government might be useful here. In the Netherlands, at the national level the government has been much more involved in national policy making and enabling stakeholders, whereas at the local level one paid in its traffic and transport plans much more attention to infrastructure. These so called masterplans that are now (being) developed in developing countries (Masterplan Delhi is a good example) are usually dealing with specific infrastructure works in a city or district.

The immediate challenge for developing countries is how to link and even integrate these local NMT plans into the overall traffic and transport plans of the city.

More than the precise activities and interventions that were carried out under the Dutch Masterplan, the useful and replicable approach might be a corner stone of any Masterplan. The issues as **communication** with stakeholders (and offering forums for exchanging ideas and experiences) and **capacity building** are relevant in all countries. **The strengthening of user platforms and NMT-advocacy groups** has already been adopted in various countries. **Decentralisation** is a phenomenon not only relevant for the Netherlands, but also other countries.

The SSATP-project is a good example how piloting (testing and demonstrating) can be useful for further policy development and promotion of NMT. The Dutch Masterplan consisted of a **significant testing and research component**.

A focus on safety and theft of a bicycle is no luxury, not in the Dutch case, neither in other countries. Statistics show that these two factors are major deterrents to NMT and unfortunately, prevailing. But the most important lesson may be that all interventions only make sense when it leads to an **integrated and consistent traffic and transport policy**. Achieving this will also depend on the **political commitment**. It turns out that a strong support from national level will smoothen the further planning and implementation of NMT activities.

### 3.5 Financing Investments

Investments in NMT seem to be limited to Governments. During the international bicycle conference "Velo Mondial 2000" an expert panel on financing investments considered NMT-investments a public task. Actually, various countries over the world show that the private sector as well as the general public is interested in directly financing investments in NMT. But, the major source of finance is indeed the central government that funds directly bicycle programmes or decentralises budgets to municipal level. The private sector pays in many cases its own bicycling facilities (free bicycle, credit, parking lots, dressing rooms) whereas the general public contributes in some cases in labour to construct or maintain the pedestrian and bicycle ways.

Various options for financing infrastructure can be identified. Some of them are mentioned by Matovu<sup>1</sup> who bases his experience on African pilots:

- **Central government budget: incidental or recurrent budget.**
- **National road funds**
- **Private sector: tourism – property developers – health insurance companies**
- **Taxes**
- **Direct user contribution**
- **Special national funds**
- **External funding form international donors and financial funds.**
- **(Inter-)national NGO's**

### Central government budget: incidental or recurrent budget

Several central governments have allocated an annual budget for NMT, to be used at local (municipality) level or at central level. The budget often covers salaries and other overhead only. Funds for “hard-ware” were delivered through other channels.

### National road fund

In many cases in the SSATP pilot municipalities budget has been received from the national road funds (based on special extra fuel tax). These extra funds are usually earmarked for road maintenance. In the Netherlands case, the ministry had a budget for subsidising a certain percentage of the investment of the lower authorities.

The investments in bicycle infrastructure may come from the general road budget as well. When bicycle needs are incorporated in the normal design and construction practices of road planners, we might reach a win-win situation: motorised traffic can go unhindered on their roads, bicyclists can make use of their paths. In an ideal world there would be no need for special NMT-funds, as NMT-provisions would be an integrated part of transport investments. Given the present arrears in NMT-provisions, special funding is indispensable to improve the situation. Such funds firstly help to shift the attention of transport planners to the specific needs of NMT-users, and secondly are necessary to catch up with the existing arrears in provision.

### Private sector: tourism – property developers – health insurance companies

The private sector is often overlooked as a partner in investment in NMT. There is hardly any information on Public-Private-Partnerships in NMT. There are some examples that developers made some beautification and accessibility provisions for their new-built residential area. In the Netherlands Tourist and environmental organisations have constructed some bicycle and pedestrian paths and established a referring system. Health and life insurance companies are expected to have an interest in making roads safer because of financial reasons. An interesting example is Sustrans in the UK: this charity organisation has constructed and implemented the National Cycle Route Network in the UK.

### Taxes

Transport related taxes are or might be used for investments in NMT. Some examples are mentioned below:

- 1) Taxing the import or purchase of bicycles has been a common practice in many countries; rates might go up to 400%. This direct taxing of bicycles is not favourable for bicycle sales and use. In Kenya there has been an increase of sales of 1500% between 1986 and 1989 after tax was cut from 80% to 20%<sup>12</sup>. So far, experiences show that revenues are not reinvested in bicycle infrastructure.
- 2) In some countries (Nicaragua, China, Tanzania) cyclists have to pay an **annual user tax** or levy to certify legal ownership. From experiences in Tanzania it is clear that these revenues were never reinvested in NMT. Like with the import tax, these taxes limit the use of bicycles.
- 3) A **road tax** for motorised vehicles exists world-wide. Usually, in developing countries there are serious problems in collecting these. The tax is generally collected in the car owner's residence;
- 4) **Bus operating taxes** are being collected in a number of countries;
- 5) Though not really taxes, we mention here: **Parking fees** from cars and bicycles. In a number of Dutch cities parking fees are re-invested in bicycle infrastructure.

Tax collection at local (municipal) level faces difficulties; lack of transparency in procedures and destination, corruption, misuse of tax-funds, “unfair” taxes result in massive tax evasion and low collection rates.

### Direct user contribution

There are quite a number of cases reported from various countries in which users contribute their labour or money to improving NMT facilities or making roads safer for

pedestrians and cyclists. Spontaneous initiatives are taken by neighbourhoods to build speed humps in order to reduce speed of motorised vehicles. Moreover, simple footbridges and footpaths are either build on private initiative or as part of a community plan.

In Dar es Salaam, as part of the World Bank SSATP project, a number of experiments have been carried out with direct user contribution to urgent NMT infrastructure improvements in lower and lower-middle income areas. Good communication and participation in decision-making and urgency of the problems to be solved are determining factors for user contribution. It makes the users more aware of total costs made by the government and stimulates people's responsibility to maintain the facilities. In quite a number of development programmes of a.o. DANIDA, 15% of the investment costs for infrastructure must be paid (in kind or cash) by the beneficiary communities.

In cases the contribution has to be paid in cash, collection problems will occur, particularly in low-income areas. Since benefits for beneficiaries accrue over a longer time period, people's repayment capacity might be limited.

One might question why bicyclists and pedestrians should contribute for facilities whereas car drivers don't have to do so. Even more so, because the need for special investments in NMT are a consequence of the pre-dominant position of MT. Further, to make the provision of NMT-facilities partly dependent of user contribution seems to undermine the status of NMT in traffic and transport policies. A discussion about up to what level user contributions would help the cause of NMT still has to take place.

#### **Special national funds**

In a number of countries, national governments have established special programmes for improving the transport sector in the country. Three of such programmes are

- 1) traffic safety programme
- 2) environmental programme
- 3) income-/job creating programme (poverty alleviation)

#### **External funding from international donors and financial funds**

International funds might be available from donors (grants) and financial institutions (soft loans) for mobility or NMT-programmes. These funds might trigger off local awareness, professional capacity and enthusiasm. Attention can be attracted through successful demonstration pilots for which local budget would have never been made available. Matovu argues that medium-size grants are more efficient than loans due to the fact that many beneficiaries belong to low-income groups. Further, its higher flexibility in fund handling is appropriate to the characteristics of such projects. However, the author states that large-scale urban infrastructure construction programmes to enable low-cost urban mobility can and must be programmes of entirely local currency expenditures, financed with local currency revenues. The reason for this statement is that, according to Matovu, these programmes can contribute more to the national economy than programmes that heavily rely on imports of goods and services.

In the international expert meeting in Delft, June 2000, the participants have ranked the tax on motorised vehicle acquisition and use as most important source. Community contributions are considered second-best. Development tax, property tax and traffic fines as respectively number three, four and five.

#### **(Inter-)national NGO's**

NGO's seldom focus on (pure) construction activities. Their programmes usually consist of a number of capacity building activities, training, education, awareness building etc.

### **3.6 Capacity Building**

The institutional environment has been identified as the key deterrent in the use of bicycles (chapter 2). In a number of reports lack of capacity (human and financial) is

mentioned as a crucial factor, hindering further development of NMT in urban areas. Capacity building involves the creation of an enabling environment, where sound institutions and adequate human resources (quantitatively and qualitatively) are present. City governments in an increasing number of countries have received the mandate to plan and manage their transport systems. However, institutionally city governments are often not ready to deal with this important task.<sup>13</sup>

### **3.6.1 The required qualifications of those responsible for preparing and implementing transport policies:**

It must be recognised that a successful local authority policy requires capacity building at the local level to create a body of experienced and well trained technicians and transport managers, who are able to advise local leaders on their choice of system and policies, based on current practise.

They should therefore:

- Have a sound knowledge of transportation facility design, environmental impact mitigation, traffic flow analysis, traffic control, and transportation planning;
- Use a multidisciplinary approach to the solution of transportation problems. This can be realised either by the engineer being trained in all the related professions, or by working with professionals from other disciplines;
- Update their knowledge on technology and management as the world is changing fast and is becoming less predictable;
- Have a growing degree of interaction with other disciplines and problem areas through:
  - a) Professionalisation of “NMT”-knowledge and updating of professional technical knowledge by learning new techniques along the traditional tasks of the engineer;
  - b) Institutional integration so that the engineer grows out of a restrictive project approach and becomes more knowledgeable about costs and community management.

These training courses should be more practical and down-to-earth. They should focus on increasing engineer’s ability to design for local solutions.

The following box presents a case study from Kenya.



### Case Study from Kenya concerning Human Resources in Transport

According to a 1999 report titled *Human Resources Development Strategy* of the Ministry of Local Authorities, Kenya has 165 local authorities, comprising of 44 municipal councils, 60 town councils, 60 county councils and the Nairobi City council and employing in total 40,000 people.

The problems related to human resources in these local governments are:

- Limited human resource capacities in place at senior and middle levels, resulting in a large number of unskilled staff who lack clear direction, instruction, reporting system and motivation.
- Unpredictable fluctuation of senior staff between local authorities and a large number of senior and middle staff positions remain vacant for considerable periods.
- Low wage and salary levels, resulting in poor motivation and absenteeism.
- Absence of policies and strategies for human resource development both at the central government and local authority level.
- Non-existence of professional associations for the chief officers working in the local authorities. Little or no information and experiences are shared between the local authorities.

Nairobi counts 2.14 million inhabitants (National Census 1999) and grows with 4.8% annually. The Transportation Unit of the City Engineer's department has 96 approved positions consisting of 20 engineers. Currently, the top three positions and 13 other positions for engineers are vacant. There are only 4 engineers, all with BSc. qualifications to carry out all the transportation duties of the city. Due to this undercapacity of staff (80%!!!) the four engineers are permanently involved in solving emergency problems, at the expense of proper transportation planning and management.

This undercapacity of staff is also prevailing in many, if not all other councils. Problems are sometimes "solved" by assigning un(der)qualified staff.

The problem of lack of staff does not only occur within the councils, the universities also suffer from this. The course on traffic and transport engineering has not been giving for the last 7 years at the University of Nairobi.

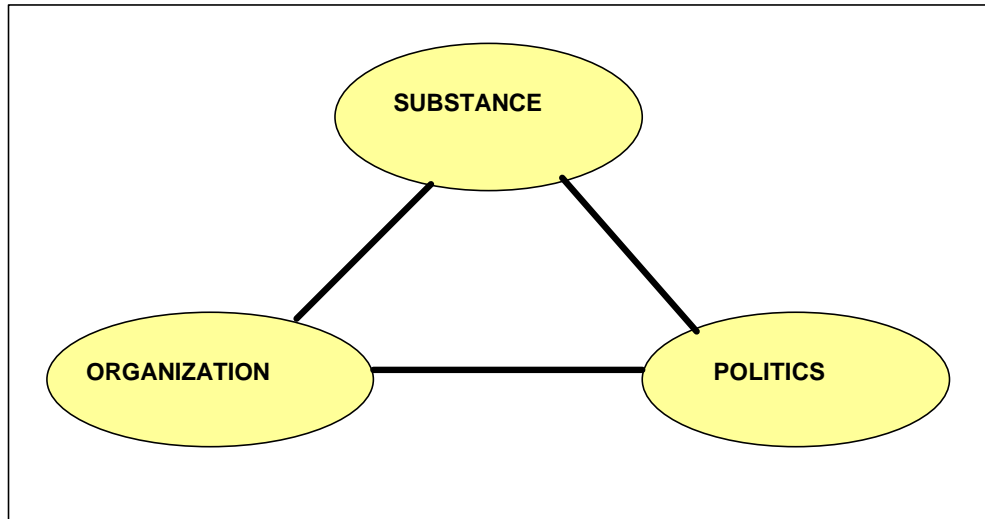
Source: *Human Resources Requirements in Local Authorities* (Opiyo, 2000)

In chapter 7 we widen our scope and include other aspects of capacity building as well. The focus will be on:

- policy development
- developing expertise
- sustainable financial mechanism
- benchmarking and guidelines
- local interest group mobilisation and support

### 3.7 Lessons learned

From each of the above presented case studies a set of lessons learned can be derived. I-ce (a Dutch centre of cycling expertise) comes up with a more or less abstract model, in which the conditions for sustainable bicycle plans are given, based on their world-wide experience. It is called the Cycling Policy Triangle; its components are the following: substance, politics and organisation.



states that without an adequate internal management in the project and without political support or commitment and without a proper bicycle plan, activities to promote bicycle use are unsustainable.

The circle on top (substance) represents the contents of an action plan, including plans for bicycle networks and routes to public transport terminals, for parking and riding. It also means that criteria for high quality measures (designs and implementation) are considered and met.

The second dimension (not in order of importance) is the organisational one. It refers to capacity of planners, designers and executors to perform well. Knowledge (technical as well as institutional) and experience in management of programmes are important.

The political dimension refers to commitment of politicians and bureaucracies, their willingness to put cycling on the agenda, to endorse legislation, to allocate budget and to enable stakeholders (users, private sector, public transport operators etc.) to participate in bicycling promotion and/or fine-tune activities to their interest v.v.

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## CHAPTER 4 PLANNING FOR CYCLING AND WALKING

*“The sum of rational individual choices won’t result automatically in an optimal situation at collective level. Ultimately this will be the strongest argument for a NMT policy: that it will contribute to a more efficient transport system.”* Tom Godefrooij, bicycle expert

### 4.1 Introduction

In this chapter planning issues are put central. The first sections will deal with transport and traffic planning in a more general way and touch issues as transport management and planning (section 4.2), specific and generic NMT planning (4.3), the weighing of interests of road users during the planning (4.4). From then onwards we will narrow our scope. Networks as a basic planning concept is dealt with in section 4.5; the development of an urban mobility plan for pedestrian and bicycle traffic in section 4.6. Quality criteria and their application, road safety management and measures conclude this chapter.

### 4.2 Transport Management and Planning

Transport needs in urban areas all over the world are diverse. These needs might vary for people, travel purpose, distance and time. In chapter 2 we already identified that some people are more or less locked up in their transport-prison, i.e. the captive NMT-user; but, at macro-level it is justified to state that a multi-modal system is often required and in place. One might speak of transport markets; for each segment of that market a suitable supply should be realised. For short distances NMT appears to be the most efficient means of mobility, while for longer distances public transport or cars offer greater efficiency. The break-even-point depends on many factors, such as the variable opportunity cost of time of a traveller and the price of transport.

What modal mix is most efficient, depends on many factors and can not be easily identified. Besides factors mentioned above, it relies on patterns of land use, land prices, travel needs, existing transport vehicles and infrastructure, etc. Therefore, the figure shown in chapter 2 (section 2.7) about understanding NMT use can be easily applied for understanding any traffic behaviour and so modal split. While identifying optimal modal share, one has to define whether one focuses on the optimal share for an individual (that might differ per person) or for society as a whole (neighbourhood or city). In the latter case one should include social costs as well, like air pollution, traffic congestion, access to housing, poverty alleviation, health and traffic fatalities, petroleum imports. Thus, on an individual level the assessment of the efficiency of the various modes is often different as compared to such an assessment on a collective level. This justifies interventions that promote those modes which contribute to the efficiency of the transport system as a whole (or to a more efficient mix of modes).

Studies show us that a merely uni-modal system often leads to sub-optimal situation. Too many private cars or even too many bicycles will lead to congestion and a reduction in average speed, compared to multi-modal systems.

Designing and maintenance of NMT infrastructure on micro-level without a clear conceptual approach on macro-level is risky. There is an important interplay between these two entities: micro (the level of individual modal choice, route choice) and macro (the level of modal share, travel volume). They are interlinked and can not be dealt with without considering the other. Actually, this interlinkage can be partly found back in the concept of direct and indirect NMT planning. For instance, spatial planning (clearly not directly a NMT-issue) might have enormous consequences when is chosen for a city, where businesses and employment are concentrated in one big CBD and residential areas can be found far out of the city. The distances between living areas and working areas are then very unfavourable for NMT.

The question whether the whole city should be considered as one big network depends on the size of the city and its structure. In big cities, it is generally recommended to focus on sub-markets rather than the city as a whole. Studies have shown that a big city is divided into more or less autonomous communities. People won't cross the borders of their communities daily, and therefore traffic management and NMT-planning should take these communities as a starting point.

### **4.3 Specific and generic NMT Planning**

There are two ways of NMT planning: 1) creating specific facilities for NMT; and 2) improving generically the conditions for NMT by weakening the dominance and threat of motorised modes of transport. These interventions might consist of rerouting motorised transport, restricting access to, or parking in zones or streets, and traffic calming measures. These so-called bicycle- and pedestrian friendly measures of generic NMT planning have an area-wide or corridor-related character. Experience shows that traffic-calming measures in neighbourhoods and shopping/market areas are amongst the most effective indirect planning concepts. Restricting MT have turned out to be very efficient in supporting NMT management programmes. It often is the most effective first step when low numbers of NMT-users don't justify (yet) the investments for specific facilities. This shows that generic and specific planning for NMT should be complementary to each other, and if wisely implemented, can create a synergy. This concept underscores the fact that it is not always necessary to start with big (long-term) investments for specific modes.

### **4.4 The planning process and the weighing of interests of NMT and MT**

The question that comes in mind is how the interests of NMT-users will be considered and valued against the interests of other road users during the planning process. The box below gives us three fictitious scenarios at what moment these interests are likely to conflict and a valuation has to be made.

### Three scenarios of the valuation of interest between NMT and MT

#### Scenario 1: the ivory tower model

Planning and design for transport and traffic are merely desk-exercises of a few engineers. Interaction with and participation of stakeholders in this phase hardly take place. The demand side of mobility is not being considered. Since the engineers have a pro-motorised traffic bias, the requirements and contribution of NMT to mobility are neglected. As a result, advocacy groups for NMT don't find any response. User platforms and other groups are not existing. Planners and designers just follow their (outdated) textbooks which prescribe how the plans should look like (supply driven). To go short, there is no valuation of interests at all. Moreover, since politicians are not interested or don't see the relevance of NMT and mobility, the valuation of interest is also not taking place in the political scene.

#### Scenario 2: the populist model

This model is the opposite of the previous one. NMT is not neglected, but taken serious. Actually, there is even a bias towards NMT. Apparently, NMT is the "love-baby" of the politicians (or of the general public) and has been a topic during the elections. Policy makers, planners and designers at the departments are rather uncomfortable with this situation since NMT has become an instrument of politicians. The valuation of interests of stakeholders (road users) is not made by the department and experts but by the general public during political debates. The role of advocacy groups is important.

#### Scenario 3: the balanced model

In this model various stakeholders are involved at different phases of policy making, planning and design and valuation of interests of road users. The public debate defines the main direction for transport and traffic policy. General issues as more traffic safety, less environmental pollution, a more liveable city, less traffic jams are typically issues the public is requiring. Implicitly a valuation of the various modes of transport has been made.

The following step is the development of a City Mobility Plan for instance. A careful analysis of mobility/traffic problems and a selection of financially and politically feasible options will lead to a plan of action to solve (some of) these. The valuation of interests is based on the assessment what measures will work best to solve the existing problems with the existing budget. Cost-benefit and multi-criteria analysis are the tools for planners and designers to come up with a plan of action.

The third valuation of interests takes actually places when the plans are presented to the public for comments. Plans might be changed or just accepted. A final decision (and thus valuation of interests) is made by the City's council. At 4 different interfaces a valuation between the interests of NMT and MT takes actually place.

The present situation is probably closest to the one described in the first scenario; the second scenario can act as a catalyst to induce changes; the third scenario comes close to the ideal situation where NMT-policy is a regular part of the planning process, at expert level as well as at political level.

Actually, what is mentioned in scenario 2 is meant to be as an example of a situation, where there is no integrated or balanced way of dealing with interests. As in the first scenario, where the weighing of interest has been done entirely by the engineers, in the second scenario the weighing of interests is done either by politicians or by the general public. Advocacy groups can contribute significantly, mobilise support and act as a catalyst. It is according to some experts a necessary step to get NMT on the political agenda.

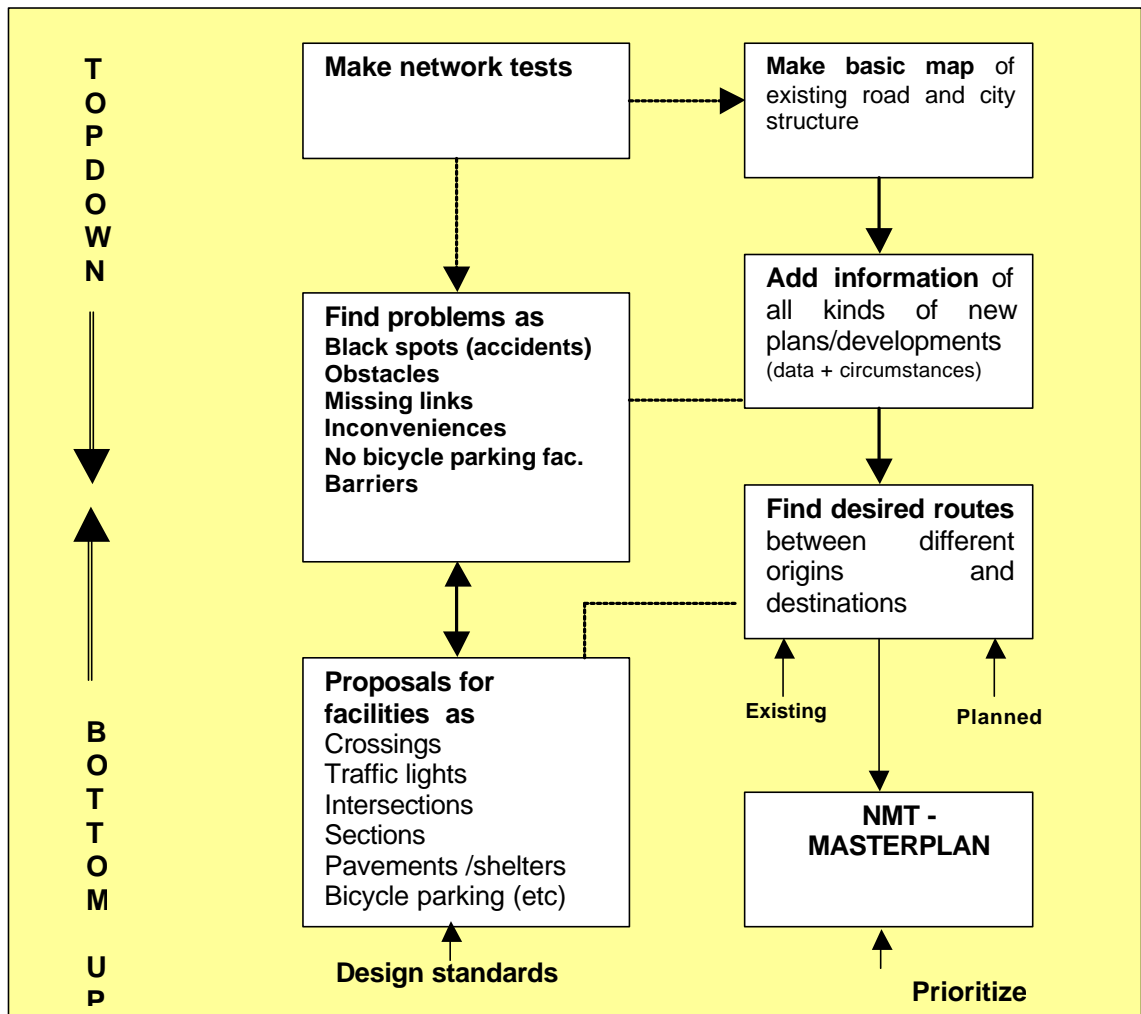
Instead of focusing on actual blackspots in the existing traffic situation, one should actually analyse the mobility need (origins and destinations) and indicate how the need can be satisfied in a most efficient way. An assessment of various modes of transport is then part of a mobility plan: it has identified the mode that suits a trip best specifies the facilities for accommodating the mobility plan and how choices for ways of transport can be influenced.

In the Netherlands the municipalities make a plan per mode of transport and try to match these with the other plans. An assessment of what the optimal modal mix would be, is not (yet) taking place. This plan-making is still a matter of planners and traffic experts who, in general, are biased. The conflict of interests between NMT and MT takes place at the design-table; promotion of NMT means quite often: less space for MT. However, when the programmes of requirements and objectives for each mode are clearer, a more objective valuation of interests can be made: this will give less room for prejudices and biases.

### 4.5 Networks as a Basic Planning Concept

Planning for NMT should aim at facilitating trips between any origin and destination within the relevant distance categories in a certain area. A useful tool to achieve this is the concept of 'network of routes/connections'. The design of the network should be based on route choice preferences of the users. This network is the basis for the selection of actual measures that facilitate walking and/or cycling. A more comprehensive description of the design of cycle route networks can be found in 'Sign up for the bike, design manual for a cycle-friendly infrastructure'.

The network planning process is a method based on mapping. It means that every infrastructure/traffic problem should be pointed out on a concrete spot and fit in the desired network. The gaps in the pattern of connections will be traced. Based on its position in the hierarchy of functions, specific measures can be designed. As a result the basic map will be revalued into a NMT map. Hereunder we will highlight the Delft and Delhi experience. But first, we present a diagram of how this NMT network planning process works out.



#### 4.5.1 The Delft bicycle experience<sup>14</sup>

The objective of the Delft bicycle network plan was to encourage the use of bicycles and to make cycling safer, quicker and more comfortable, and to reduce car-traffic. Characteristic of this network, that existed already for 75%, is its hierarchy. It consists of three sub-networks, each having its own functional and design characteristics: 1) a **city level network** for internal and external and through bicycle trips, requiring quite large-scale expensive improvements (tunnels, bridges); 2) a **district (inner-city) level network** for connecting main facilities within the district and collecting/distributing bicycle traffic to and from the urban network, requiring less expensive, investments (bicycle paths, lanes, small bridges, improved junction lay out, etc); and finally 3) a **sub-district level network** to serve trips within the neighbourhood and provide access to premises (short cuts, paths, small bridges etc). Gaps in the network were solved, direct links increased and other activities such as under 2 were implemented. All this with the intention to increase the safety, directness and comfort. As the evaluation shows bicycle use increased compared to the control area (without interventions) and with leaving out other factors, in terms of kilometres per capita and number of trips. Especially, additional trips were made by former walkers and car passengers. The route choice changed as well. New facilities were used, but, only when they were at the same length as the former one (the volume increase has been caused for 58% by route shift, no external increase). It did improve the safety situation, since these new facilities were often separated paths, which are by their nature more safe. Car use, as the second objective, did not increase. The percentage of short trips by car did even fall. One might conclude that due to improved cognition and perception of alternatives and the removal of detours and delays, bicycle trips were longer on average. Also the bicycle was used more often for certain purposes such as shopping. The total modal share changed to the advantage of bicycles (from 40 to 43%), car and walking remained stable (26%). Public transport went down (from 6 to 4%). The share of bicycle use increased since facilities are no constraints anymore and become more competitive.

Interesting to know is whether the approach that is common practice in the Netherlands nowadays, is applicable in other countries. The project evaluators and various key informants believe that the approach is transferable, but do not mention under what conditions.

#### 4.5.2 The Delhi Bicycle Master Plan

The Bicycle Master Plan for Delhi<sup>15</sup> is based on the experiences from the Netherlands and proves that the network approach can be used in other countries as well. The plan, drawn up by TRIPP, highlights the benefits of a more NMT-friendly city and show some examples of how that can be achieved by reconstructing roads.<sup>16</sup> Its basic concept is network planning, which is elaborated as “network route planning”, “road section planning” and “intersection planning”. In order to promote cycling, a recognisable network of links and junctions has to be developed where the need for detours is minimised and the number of encounters between cyclists (and pedestrians) and motor vehicles are reduced. A special focus is directed to through routes where high numbers of NMT-users can or do make use of. Investments on these routes are more efficient since NMT volume is high. Besides, to make the network effective, less-intensively used routes have to be included to create a coherent structure. In their phasing of interventions such a prioritisation based on volume of NMT-traffic and their function has been pursued:

Phase 1: routes with heavy NMT use, where NMT-users have to share the road with MT. Beneficiaries are NMT- as well as MT-users.

Phase 2: routes with fast traffic are to be reconstructed to secure safe cycling and walking.

Phase 3: smaller roads have to be reconstructed as part of the bicycle plan.

In a later stage, the network should be developed in such a way it serves distribution at district level, and access on neighbourhood level. Traffic calming measures are then more suitable and cost-effective than separated bicycle tracks.

Once the routes are selected and prioritisation has been made, road section planning (what to do with the lay-out: separation or mixing) and junction/intersection planning has to be dealt with. Especially at intersections, interests of different modes come together, which the planner has to solve. In that process of finding the optimal solution the planner is searching the correct balance between shape, function and use. This process will be the subject of next section. For now, we can conclude that the network planning has been a successful approach in the Netherlands, and can be easily transferred to developing countries. The existence of a dense, coherent and consistent network of bicycle facilities improves cycling conditions and its use. Since there is no uniform- but scattered - origin destination patterns, focusing on a few major routes won't help so much.

A hierarchical functional design encourages the use of the bicycle network; if each level in the network will have its own spacing and design, a logical structure becomes visible. Besides cost-saving aspects (not every route needs expensive adjustments), such a network will help to improve recognition and perception of bicycle travel possibilities.



## 4.6 The urban mobility plan for pedestrian and bicycle traffic

In this section we will describe the approach of development of an urban mobility plan as it has been recommended in the guidelines for pedestrian and bicycle traffic in African cities<sup>17</sup>. The approach is that planning is a learning process ('learning by doing'), where adjustments should be possible. A mobility plan is essential to provide the direction and continuity of improvements in urban NMT facilities. It further may encourage relevant departments (planning, transport, land use) to work closer together. The 'learning by doing' approach would imply that feed back stages are an essential part of the process.

Though not meant to be a blue print, the following stages are recommended to be followed:

- 1) Establishment of a proper organisational set-up for urban mobility planning and implementation, of a user participation set-up and of financing arrangement for interventions.
- 2) Preparation of an inventory of user needs and of a NMT route network inventory and problem inventory.
- 3) Preparation of a NMT action plan ('pilots').
- 4) Preparation of a long-term urban network plans (as the framework for intervention selection; no urban mobility plan yet).
- 5) Design of a first package of interventions (using: design concepts, detailed design aspects).
- 6) Appraisal of the proposed interventions (and the action plan), approval and a start with implementation (after the first package, the second etc.).
- 7) Development of a complete long-term mobility plan and policies.

As can be derived from the above, before starting an urban mobility plan, it is recommended to kick off with a down-to-earth action plan (under 3). The advantage of this sequence is that an action plan forces a practical orientation and can provide valuable experiences and knowledge about mobility problems, to be used as input for a mobility plan. These actions should be planned as pilot projects, with much attention for the criteria for success. One should be very careful in avoiding obvious failures. We won't go here into more detail about the establishment of an action plan. Hereunder the steps to be taken are listed for the preparation of an urban mobility plan.

See	Steps to be taken:
4.6.1	Carry out a SWOT analysis of the urban transport system (strengths, weaknesses, opportunities and threats)
4.6.2	Provide an overview of the existing road infrastructure and land use: <ul style="list-style-type: none"> <li>• inventory of existing pedestrian and bicycle routes</li> <li>• map of public transport routes and major motor vehicle roads</li> <li>• maps of land use and important traffic attractors</li> </ul>
4.6.3	Analyse the present mobility at macro level: transport system performance
4.6.4	Analyse the present mobility at micro level: understanding changes in the transport system
4.6.5	Analyse the present mobility: make an inventory of user needs
4.6.6	Investigate different urban transport policy scenarios
4.6.7	Choose mobility policies
4.6.8	Design the network of pedestrian and bicycle routes that must be established in the next ten years
4.6.9	Choose design standards

The municipal government is the authority to take the initiative to start the planning process. Three tasks can be identified:

- 1) Identify and understand the forces that determine the long-term development of urban transport (traffic generation, location choice, vehicle ownership and modal split).
- 2) Identify the main stakeholders and their influence/role
- 3) Identify effective instruments

As a very start of the planning process a workshop of one-week can be carried. This can be called the “quick-and-dirty” workshop in which the outline of further steps is made and an initial attempt is made to collect and analyse basic information. It provides some input and structure for the following steps:

#### **4.6.1 SWOT of the urban transport system and the role of NMT**

The SWOT workshop is a suitable instrument to start the preparation of a mobility plan. A number of 15 to 20 people who are engaged in transport and related issues (and users) will focus on the strengths, weaknesses, opportunities and threats of the mobility situation. Such SWOT-analysis could be done for each mode separately and for the total transport system. Prior to this (or as part of the workshop) a stakeholder analysis can be conducted. The workshop should also be used to agree upon a 'mission statement' which can be used as a reference for the development of policies and interventions.

#### **4.6.2 overview of existing land use and road infrastructure networks**

In the mobility plan 5 maps will have to be presented concerning:

- 1) the current land use
- 2) main trip attractors
- 3) public transport routes
- 4) main motorised traffic routes maps
- 5) NMT network (if available)

By providing information on various transport modes an integrated perspective is offered. These maps will be the basis for showing the future or expected land use, trip attractors and networks of NMT and MT.

#### **4.6.3 macro analysis of the present mobility: performance and costs**

In this step one quantifies the basic information that is needed to understand the scale, composition, performance and cost of the transport system. The most important issues to clarify are: how many trips are made in the city every day, by what modes of transport they are made, what distances they involve, what they cost and how much time they take. Once the information is obtained, one can start looking for the answers to the following questions:

- what does the current travel situation cost and what mobility, comfort, and accessibility does one get in return?
- how do the existing system parameters (trips made per day, average travel speed, unit cost per passenger/kilometre and accident/kilometre differ with other places where urban transport scenarios were developed? What explains the differences?

#### **4.6.4 micro analysis of the present mobility**

Here an emphasis is paid to individual travel characteristics and travel behaviour. Interviews with households and road users form part of this step.

#### **4.6.5 Inventory and assessment of user needs**

For finding out the user needs one can organise participatory workshops and feedback meetings (to certify that the results of earlier meetings are valid). It is important to get the priorities and relevance of mobility right. If other issues are much more important

than mobility, one should consider the relevance of the plan or adjust the plan. In that case one might consider starting community development activities where improving living conditions (housing, sanitation and employment) is put central. NMT development can be gradually linked or integrated into these as a natural alliance.

The selection of unbiased participants is important. A large number of focus group discussions and user platform writing sessions will result in a document "inventory and assessment of user needs".

It goes too far in detail to present possible contents but it may touch experiences, problems and needs, actual and potential conflicts between road users, blackspots and what has to be done.

#### 4.6.6 urban transport scenarios

Scenarios are a good way to discuss and compare different visions on urban transport developments with a wide variety of people. One can identify three prototype scenarios:

##### **Laissez-faire strategy**

This is the situation where no clearly defined (NMT) transport policies are formulated and/or implemented. Activities carried out are uncoordinated, unrelated and very ad hoc. A rather chaotic traffic situation is the result, in which NMT users find themselves endangered.

##### **Urban highways strategy**

An alternative scenario is that of highway construction in and around the city to avoid traffic jams. Usually these highways connect the inner-city with new urban residential and industrial areas, which are quite far out of the centre.

##### **Traffic demand management strategy**

An active approach, to enhance or restrict certain modes of transport for specific trip purposes. An example of this restrictive demand management is the parking policy in inner-cities in Western Europe. Further, toll ways (electronic toll systems) in urbanised areas are another example. Traffic demand management, by offering or not offering a specific service, will have an impact on land use and activities.

The final selection of the strategy depends on factors as:

- Estimated travel cost in future compared to available income per person
- Mobility of an individual
- The average travel time per inhabitant
- Investment costs
- Environmental impact
- To what extent it contributes in meeting the user needs
- To what extent it is consistent with the outcome of the SWOT results
- Costs of required investments versus estimated benefits (with regards to transport efficiency, but also more general and economic benefits) (criterion value for money).

#### 4.6.7 Choice of mobility policies

At this stage of plan development the options for mobility policies within each strategy must be identified and chosen. Policy fields might include: pedestrian and bicycle traffic, traffic calming and safety, traffic management, public transport, taxes affecting land use and transport, road reserves and public open spaces, spatial planning, traffic behaviour and education, police enforcement and environmental issues. There are mainly two major criteria for decision-making:

- the expected positive contribution towards the preferred transport strategy
- the expected impact of a certain policy on future mobility, travel time, costs, user needs, road network requirements and environmental quality.

## 4.6.8 Design of the future network of pedestrian and bicycle routes

### 4.8.1.1 Design of a pedestrian route network

Based on all the information collected one can make a map based on the one prepared in step 2. The below schedule is an indication how a map for a district can be developed for a pedestrian route network.

Step	Description
1	Identify missing links in the existing network, and to identify alignments that can be chosen to provide for the missing links.
2	Make a map with the expected main future trip origins and destinations in the area
3	Make an estimate of the pedestrian share in the trips along each "desire-line" on the map
4	Make on a copy of step 1 the main future pedestrian "desire-lines"
	Match the desire-lines with the network already existing and indicate additional alignment requirements. Minimise conflict points
5	Test the draft network against the user requirements (safety, comfort, directness, coherence and attractiveness)
6	Test the draft network against the provider requirements (cost-effectiveness, sufficient route network density, availability of sufficient public road reserves)
7	Prepare the final map with individual main routes, starting and end points.
8	Verification (physical)
9	Check road reserves

### 4.8.1.2 Design of a bicycle route network

There is a huge difference between planning a bicycle route network for a city where cycling is an established mode of transport with a significant modal share and for a city where it only plays a marginal role.

#### Cities with a minor share of cyclists:

In cities without an established cycling culture, the construction of a network of separated bicycle track has a high chance of resulting in failure. Opening such a network does not mean that there will immediately be a high volume of cyclists using it. A perfect example from Ghana, where a high standard (and costly) bicycle track is laid down in a low-density area, shows that the road will be intensively used, except by bicyclists (for drying beans, playing, walking etc.).

Further, like in Lima, the stretch might be very difficult to reach and lead from nowhere-to-nowhere. Since the new track will be just part of the trip, the access roads should be safe and convenient as well

The question to be answered is at what scale or area one should start to make investments for a bicycle network. The answer depends very much on the size of the city; it is recommended to start "not too big": in a big city it means one should start with just one district; in a small/medium city one might cover the whole city. Such district would serve as a pilot to demonstrate the feasibility of cycling as part of the urban transport system. It is therefore important to maximise the chance for success. Criteria for selection the district are:

- Low or low/middle income district (in the lowest income population are bicycle ownership can be too low)
- High proportion of medium distance trips to work (3-8 km).
- Moderate motorised traffic density
- No significant gradients

The next question to be answered is what type of route network can be best aimed at. To prevent the problems like mentioned above, it is recommended to start with generic improvements of the road network (see section 4.3). Improving road safety by introducing traffic calming measures on existing roads where cycling in mixed traffic can be made safe. Thus a provisional network of 'quiet back streets' can be created. This network can be made more visible by signing and small additional facilities such as small scale bicycle parking facilities, crossing facilities, et cetera. Furthermore, one should identify missing links in the network of potential safe roads so that directness is improved. This approach should help to concentrate cycling on certain routes, and thus make it more visible. It should also sustain and expand the existing cycling to levels that would justify investment in more appropriate special facilities.

At neighbourhood level one can integrate bicycle and pedestrians easily since bicycle use is still limited.

#### **Cities with an important share of cyclists:**

The question how a network should look like for the future is already answered in the previous sections. The issues mentioned for interventions in non-cycling cities are valid here as well: improving safety and provision of missing links.

The most important challenge of the bicycle network planning is the establishment of a core structure of bicycle arterial routes throughout the entire city, which are clearly recognisable as a special investment in improved urban cycling.

#### **4.6.9 Choice of design standards**

Design standards of roads are poor in a lot of cases, or at least incongruous with the composition of actual road users. If existent, they often don't address the specific needs of NMT. In a number of countries design standards have not been laid down. It is recommended that they will be as part of the mobility plan.

### **4.7 Quality criteria**

Based on Dutch research on the impact of experimental NMT infrastructure facilities, one can conclude that there are five main requirements more or less representing all wishes of users regarding the infrastructure<sup>18,19</sup>. Again, these criteria go for pedestrian as well as for cycle facilities.

#### **4.7.1 Coherence, Directness, Comfort, Attractiveness and Safety**

##### **1 Coherence**

Indicators for coherence are among others: ease of finding, consistence of quality and freedom of route choice. The system of NMT facilities has no gaps and is linked to the main points where cyclists and pedestrians begin or complete their journeys; complete NMT networks provide connections between all points of origin and destination. It would imply:

- Easy access to main network at points of origin and destination
- Integration with public transport
- Hierarchical approach (i.e. urban, district and neighbourhood network)
- Constant route quality and easy to recognise

## 2 Directness (indicator = travelling time gained and detour factor)

The system of NMT connections provides NMT users with a route which goes as directly as possible to their destinations, in which any detour and waiting time at junctions is reduced to a minimum. It implies:

- Finely meshed network (limiting detours)
- Short-cuts wherever possible to bridge natural or man-made barriers
- Connections traverse major car corridors as little as possible
- Straight paths and no detours at junctions
- Minimising delays, well regulated traffic lights

## 3 Attractiveness

The NMT facilities in an area should be designed and fitted into the built and non-built surroundings in such a way that it is pleasant to go cycling or walking. This means shading, absence of mud and dust, little exposure to exhaust of cars, socially secure and an attractive surrounding, among others. This means:

- Connections coincide as little as possible with major car corridors
- Connections pass through attractive, shaded or green environment
- Alternative connections available to avoid insecure spots
- Socially secure lay out (street lights, no dark hiding places)
- Facilities that curb speed or MT intensity, such as shrubbery or street objects

## 4 Traffic safety (indicator = less accidents)

The NMT facilities guarantee the road safety of the cyclists and pedestrians and the other road users. Fewer accidents will occur. The general approach to safety is: to minimise the encounters between NMT and (high volumes of) speeding motorised transport. This can be achieved by segregation of modes, or by traffic calming (see also chapter 5). A safer network and road design implies:

- NMT-connections coincide as little as possible with major car corridors
- NMT-connections cross major car corridors as little as possible
- Alternative connections available to avoid unsafe connections
- Facilities that curb speed or MT intensity, such as shrubbery or street objects
- No mopeds on cycle paths or walkways
- Paths enough wide
- At junctions, reduced car speed, traffic light or crossings at different levels
- Good layout at junctions
- No obstacles (poles, containers, badly parked cars etc.)

## 5 Comfort

The NMT facilities allow a rapid and comfortable flow of NMT (so, capacity is large enough to prevent pedestrian and bicycle congestion); it means cycling and walking in a steady cycling speed without any hindrance, caused by bumps and potholes, gradients, stopping at junctions. It also refers to possibilities to shelter or to park the bicycle. The implications are rather at technical design than on network level.

### 4.7.2 The application of quality criteria

The above criteria are now globally used and found practical. The elaboration of these criteria might vary from one place to another. A lesson learnt is that one should consider these five criteria in connection with each other to be most effective; however, some criteria can not always be met: directness is at odds with safety if the cycle path has to go through a no-go area, or with attractiveness if it is along a busy truck road. Although it is obvious that safety is of major importance, one should not too easy make

compromises on directness and comfort, as these requirements are important determinants for use. The implication is that restrictive measures for motorised traffic may be necessary to meet the criteria.

One or two major weak points can undermine the high quality of a route. It is therefore a waste of efforts and money to invest in a few expensive, high quality bicycle routes in a city where cycling is not safe, especially on access or collector roads. A programme to attack the problem spots on potential cycling routes has much more sense and is more cost-effective than to lay-down a single expensive, high-quality bicycle route. An inventory of all measures necessary to implement the complete network enables the road authorities to prioritise these measures on the basis of a multi-criteria analysis. Thus the best value for invested money can be achieved.

On a neighbourhood NMT connection, directness is much more important than comfort. Another finding is that pedestrians and cyclists in high volumes do often not mix well on the same track, due to speed discrepancy.

#### **4.8 NMT Road Safety Management Approach**

Road safety is among the most expressed needs of NMT and MT-users in urban areas all over the world. The speed and volume of cars, trucks and buses are particularly threatening to cyclists and pedestrians. Together with bad driving behaviour, they come often into mind when discussing about safety and promotion of bicycle use. In cases with growing motorization (as is in many developing countries the case) it is absolutely vital to protect the remaining NMT against the threat and actual dangers of this motorization.

It has been recommended by experts to develop a NMT policy in which safety is put central. By doing this, it should target on 2 issues:

- 1) reduction of risks, and so the number of accidents and casualties per cycling kilometre.
- 2) reduction of traffic complexity for NMT-users in urban traffic.

In section 4.9 we will go into some more detail about road safety measures. Here it will suffice to focus on three broader concepts:

##### **Increasing the number of route options for cyclists / pedestrians**

This will allow the NMT-user to choose the safest option and avoid the dangerous ones. If a complete and coherent network of well-maintained routes exists, overall safety for NMT-users is increased. With the lay-out of a network one should consider the quality of the road surface as well. Too steep slopes, bends, puddles and other things that might cause unexpected manoeuvres by cyclists should be avoided.

##### **Minimising and/or softening confrontations between motorised traffic and cycling / pedestrian traffic**

This can be done by segregation of transport modes on roads where speed discrepancy is and remains high. Or one could also reduce the speed differences between the various modes. Moreover, at junctions mode-specific traffic lights can be installed.

##### **Improving the competitive position of the bicycle/pedestrians in relation to car traffic**

Reduction of the volume of car traffic is an option, by prohibiting cars to enter zones or streets. Further, one could minimise waiting time for cyclists and pedestrians and so avoid dangerous crossings. The design of infrastructure should strongly support the right of way for cyclists. Further, by upgrading facilities and maintaining them safety can be increased. For instance, potholes force cyclists to make sudden moves towards the road axis.

## 4.9 Road Safety Measures

### 4.9.1 Speed control

Speed control is a very efficient means to reduce accidents on the roads. Not only the absolute speed of the fastest vehicle is involved, the differentiation between the various road users as well. The lower the maximum speed, the less chance for getting an accident. Data shows that after the introduction of a maximum speed relaxation in the USA (from 55 to 65 mph), resulting in an actual increase of 2-4 mph, the fatality rate increased significantly. In some states the fatality rate even increased with 34%. After speed limit reduction from 60 to 50 km/h in Zurich, 24% fewer pedestrian fatalities were recorded. Same figures revealed from a study on the effects of speed limits, carried out in 21 countries: reducing speed limits from 60 to 50 km/h will result in a reduction of 25% fatalities and casualties<sup>20</sup>.

Table 12 The probability of a fatal cause for a pedestrian after a collision with a car at various speeds

Speed	30 km/hr	40 km/hr	50 km/hr	60 km/hr
Probability of death	5-8%	25%	45-80%	>85%

There are various ways to control speed: The most obvious method is **police enforcement**. This method is requiring a lot of person power, and therefore not very effective and efficient in practice, if one had to rely on this method only. As an additional means it is still important.

Today's most accepted method is 'traffic calming' i.e. infrastructure measures like humps, chicanes et cetera, which impose the required speed behaviour on motorists.

More innovative is the IT-approach: speed recording systems, intelligent speed governors and such. These systems adapt the vehicles maximum speed to what is appropriate in the situation.

The IT-approach is very promising for the future, but for today traffic calming is the most feasible option.

### 4.9.2 Road design

Measures in road design to improve the road safety for vulnerable road users usually refer to traffic calming measures. As has been presented in this chapter, a whole range of measures can be taken; besides, the construction of pedestrian crossings, special bicycle tracks or walkways, a physical separation between the road shoulder and the carriageway can help to reduce risks.

### 4.9.3 Vehicle design

Though it is more useful to put efforts on the prevention of collisions, it is still worth to focus on designs of cars, buses and trucks. Especially the latter two are often involved in accidents with NMT-users and a deadly cause. It has partly to do with the design of the front of these vehicles which is vertical and therefore hits the more vulnerable parts of human body, chest and head, more severely<sup>21</sup>.

Further, one could think of an in-vehicle speed-controller, a standard one for urban areas (maximum speed 50 km/hr) or one that starts working when particular moves are made (bending) or under surface characteristics (bumpy road), or on speed recorders.



This technique, called ISA, Intelligent Speed Adaptation, can reduce speeds at any desired road without physical facilities like speed humps, but is still under research.

The further development (and enforcement of its use) of rear view mirrors, so that turning vehicles are able to see other (slower) road users should be encouraged. “Blind corners” are often mentioned by motorists as the reason why they did not see the bicyclist or motorised two-wheelers before they crashed.

#### **4.9.4 Education and awareness raising**

A fourth set of interventions includes campaigns to make the rights and responsibilities of pedestrians and cyclists known to the general public as well as the traffic rules that deal with safety. Training and educating children in and outside schools help them to understand more about traffic rules. Further, driver’s license tests could pay more attention to the interface with NMT-users. However, one of the best strategies is to get car-drivers cycling (or walking). This way they will better understand the needs and problems that NMT-users encounter. However, there is a debate among experts whether these interventions are really effective.

## CHAPTER 5 TECHNICAL AND INFRASTRUCTURAL ISSUES CONCERNING NMT

### 5.1 Introduction

In this chapter we will focus on infrastructure and technical issues that will foster the use of NMT. Designing infrastructure and technical solutions will never take place in an isolated context. Methodologies for decision-making are described. At the end of this chapter we will present some technical solutions with which has been experimented in the SSTAP<sup>22</sup> project. We will kick off with the discussion about segregation versus integration of various modes of transport, NMT and MT in particular.

### 5.2 Segregation versus integration

The decision whether various means of transport should be separated or integrated will depend on several factors. In general there are three options:

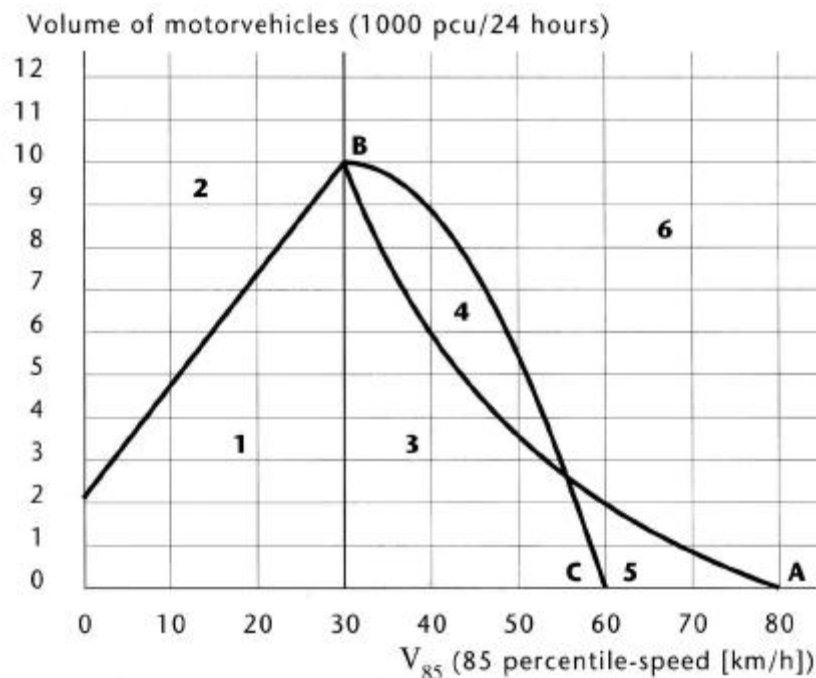
- Mixed traffic: not any single mode of transport has an exclusive right to use (specific parts of) the road; it refers to a fully integrated transport system.
- Visual segregation: The second option is a bicycle/pedestrian lane where a strip on the carriageway is reserved for bicyclists or pedestrians. Though the facility is meant to be for pedestrians or cyclists only, one can not speak of a full segregation, since the facility can easily be used by other means of transport.
- Physical segregation: The third option is a sidewalk for pedestrians or bicycle track for cyclists. Here the exclusive right of the pedestrian or cyclist is recognised. The track can not (or only very difficult) be accessed by motorised transport. Though the track or path itself is uni-modal, at intersections one will always have to deal with other means of transport.

Below a diagram is shown. The diagram refers to segregation or integration of cycle traffic and motorised traffic. It indicates roughly when one should think over particular options. As one can recognise, the main components are speed and volume.

In this graph the speed and traffic volume are the ingredients to choose between the three options as mentioned before. Safety is the goal behind this graph. In area 1 there appears to be no need for any intervention. Speed and volume are both low. A case as in area 2 hardly ever occurs. In area 3 where speed and/or volume are within reasonable limits all three options may be valid. This depends on other road or traffic characteristics and finance. In area 4 some kind of segregation is desirable, but one should choose for a cycle-lane or track. In area 6 physical segregation is necessary: both speed and volume fully justify investments in bicycle tracks for cyclists' safety. In area 5, a cycle track is desirable, but motorised traffic volumes are so low that a mixed profile is also acceptable. Cycle-lanes are not to be recommended. In 'Sign up for the bike'<sup>23</sup>, additional considerations are given to decide on what to do in case of situations within area 3. These considerations are: the parking pressure, continuity of routes, number of intersections, and the presence of tram rails.

The graph only shows the volume of motorised traffic, whereas it seems to be reasonable to take into consideration the volume of non-motorised traffic as well.

This graph, however, is based on the safety of cyclists: a lonely cyclist will be as much endangered by the situation as larger volumes. However, when it comes to building



facilities, the number of actual users of the facility will have an impact on the cost/benefit ratio of the investment, and thus on the priority.

Another important consideration is that there are 2 ways to achieve a satisfactory situation for cyclists: one could either build the facility which is recommended for the given combination of volume and speed of the motor traffic, or one could diminish the speed and volumes to acceptable levels for the existing road layout. This would require a change in the circulation of the motorised traffic network.

Further, the available road reserve, cost of construction and function of the road should be considered as well. De Langen<sup>24</sup> comes up with some useful remarks concerning mixing or separating transport modes and developed decision matrices, which are presented hereafter. He states:

- Mixing different modes of transport should be combined with traffic calming measures, so that different modes can not choose their own speed freely.
- Mixing pedestrians with motorised traffic is undesirable and only possible when volume and speed of MT is very low (<20 km/h).

- Mixing pedestrians and cyclists will usually not create big safety problems, but (depending on volume and capacity of facility) will mainly cause hindrance and inefficiency.
- Pushcarts do belong to the same category as pedestrians. Therefore they should be separated from motorised traffic in the same way as pedestrians. But existing footpaths are usually not wide enough to accommodate these carts.
- As a rule of the thumb one can state that at the lowest residential access level (with speeds below 30 km/h), traffic can be mixed. These tracks and roads are NMT domain. However, at the main transit level, the use of urban corridor carriage-ways should be restricted to motor-vehicles only and NMT should be completely separated. But on most roads (local collector and collector) bicycles can be mixed with MT (pedestrians can't!).

On a general level one could observe that there is a big difference in the manoeuvring of pedestrians on the one hand and riding traffic on the other. The implication is that in many cases it is more appropriate to integrate cycling with motorised traffic than to integrate cycling and walking. Banning the bicycle from the main road to the sidewalk is no good alternative.

Actually, as De Langen argues, separation of pedestrians and carts on road sections does not eliminate traffic accident hazards for them. In fact, crossing of the main MT traffic corridors and collectors is often the most dangerous part. Also at intersections some kind of segregation is possible. This could be done by segregation in time (i.e. traffic lights) or segregation in space (i.e. grade separation: tunnels and bridges). Such solutions however can be very costly, or not feasible within the existing situation. Therefore speed reduction at intersections is an indispensable option to improve safety.

Based on the considerations above, De Langen comes with the following ranking for priorities in interventions:

- 1) safe crossings at intersections and mid-block
- 2) separation between pedestrians and MT on all roads apart from access roads, by means of walkways
- 3) traffic calming to create safe cycling conditions on all local collector roads and most other collector roads
- 4) consider bicycle lane markings on wide-lane collector roads, or provision of bicycle traffic capacity on service roads along urban corridors, or separated bicycle tracks.

### 5.3 Hierarchy in urban road network

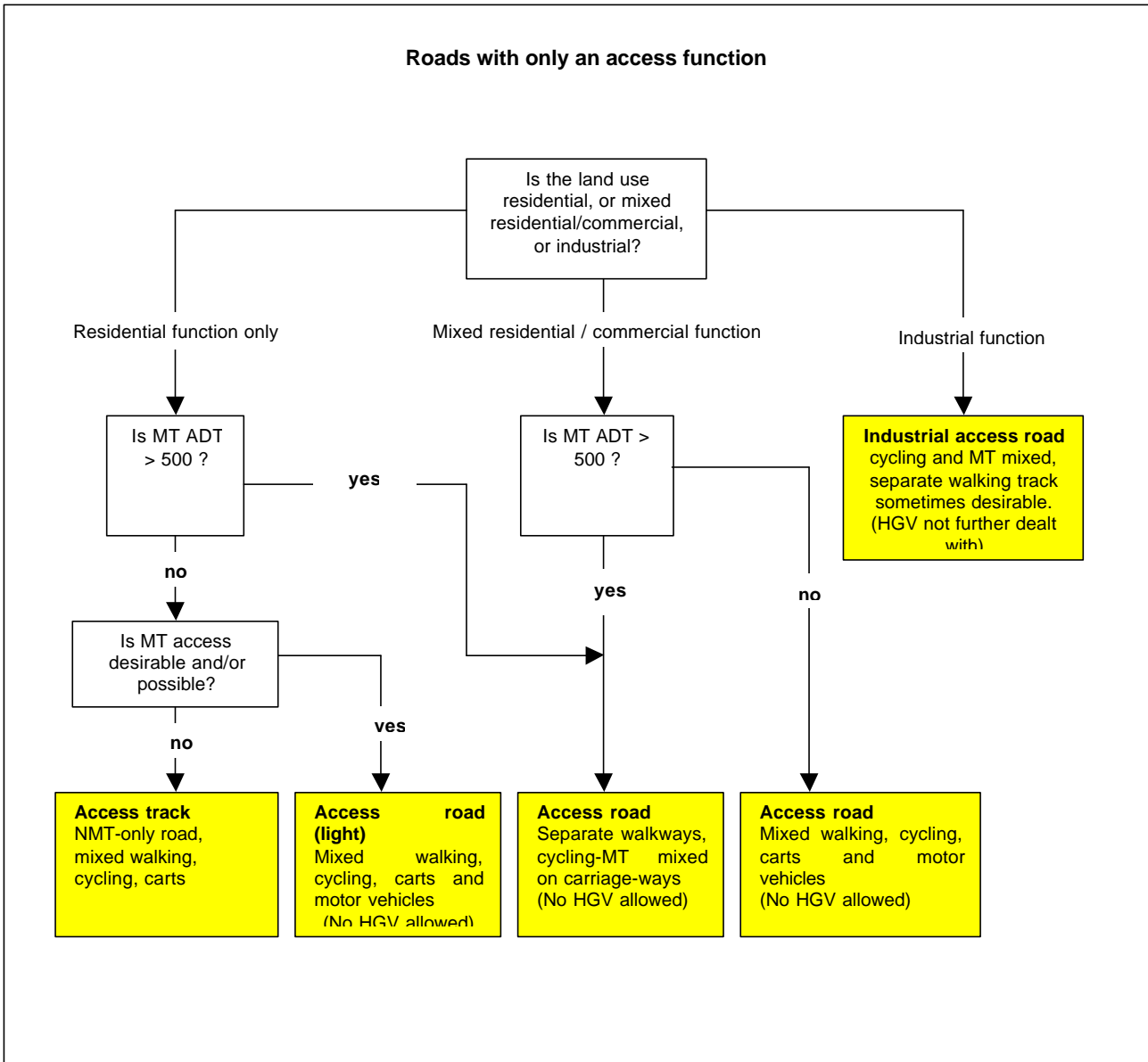
Road safety of all road users, including NMT-users can benefit from a road system which will contribute to a more predictable behaviour of road users. In the Netherlands and Sweden such predictable road behaviour is advanced by creating a limited number of road categories with their specific function each, and a road design to promote the envisaged use. (Thus creating the balance between function, shape and use; see 5.4.)

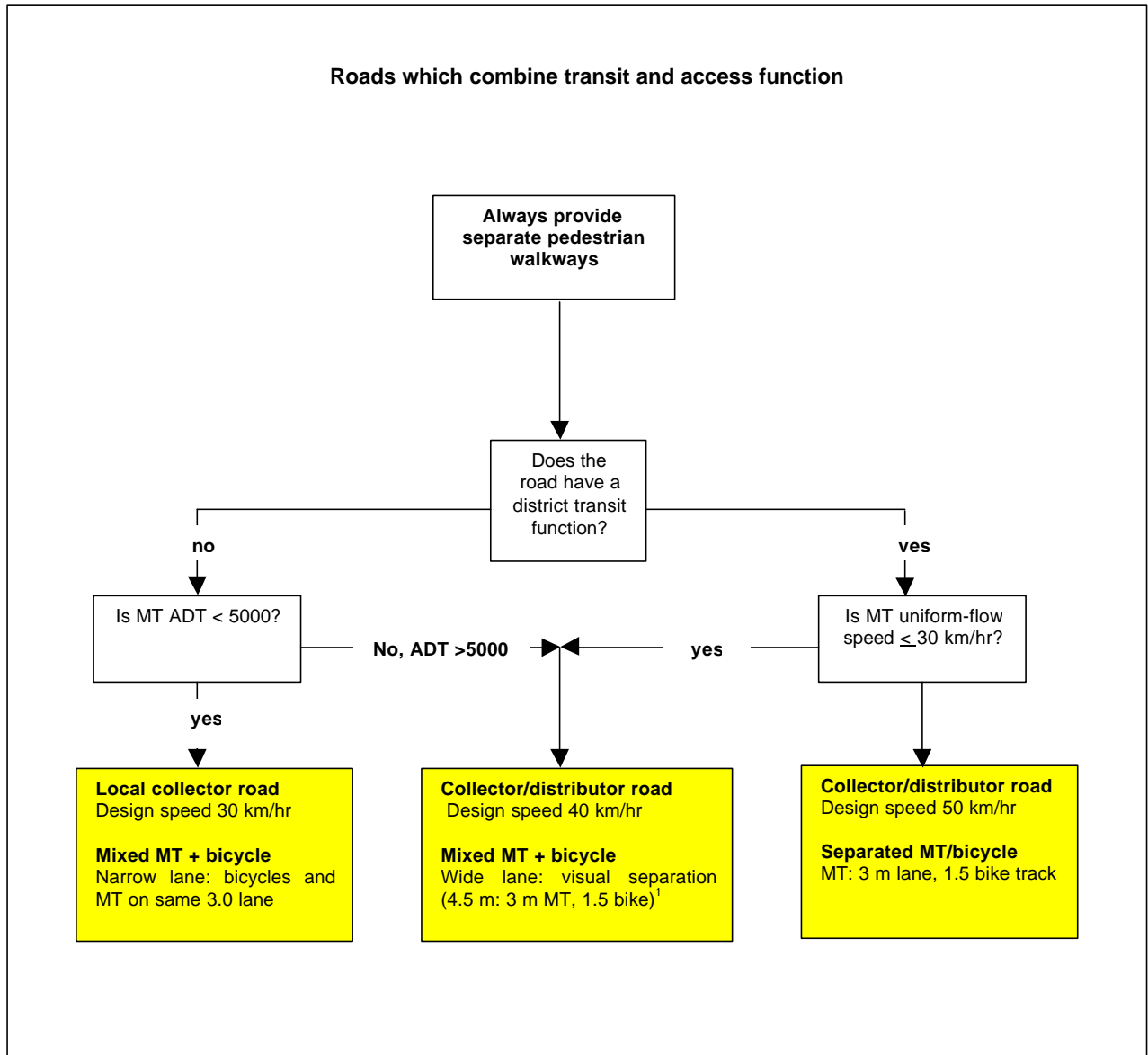
The main categories are:

1. Transit road: these roads are designed for large flows of traffic on longer distances. On these roads there is no direct access to individual addresses. Traffic is meant to flow only.
2. Distributor roads: these roads are designed to enable the road users to find their way to the area of their destination, but don't give direct access to individual addresses. The distributor road should allow for turning manoeuvres of road users finding their way. A moderate low speed is appropriate to allow road users to react to sudden manoeuvres, and to 'negotiate' with other road users. These roads may sometimes have a 'transit' function for NMT-users.
3. Access roads: these roads are primarily meant to give access to individual addresses, and should allow for stop-and-go situations at destinations and other activities around homes and businesses. Low speeds are imperative. The needs of NMT are indicative.

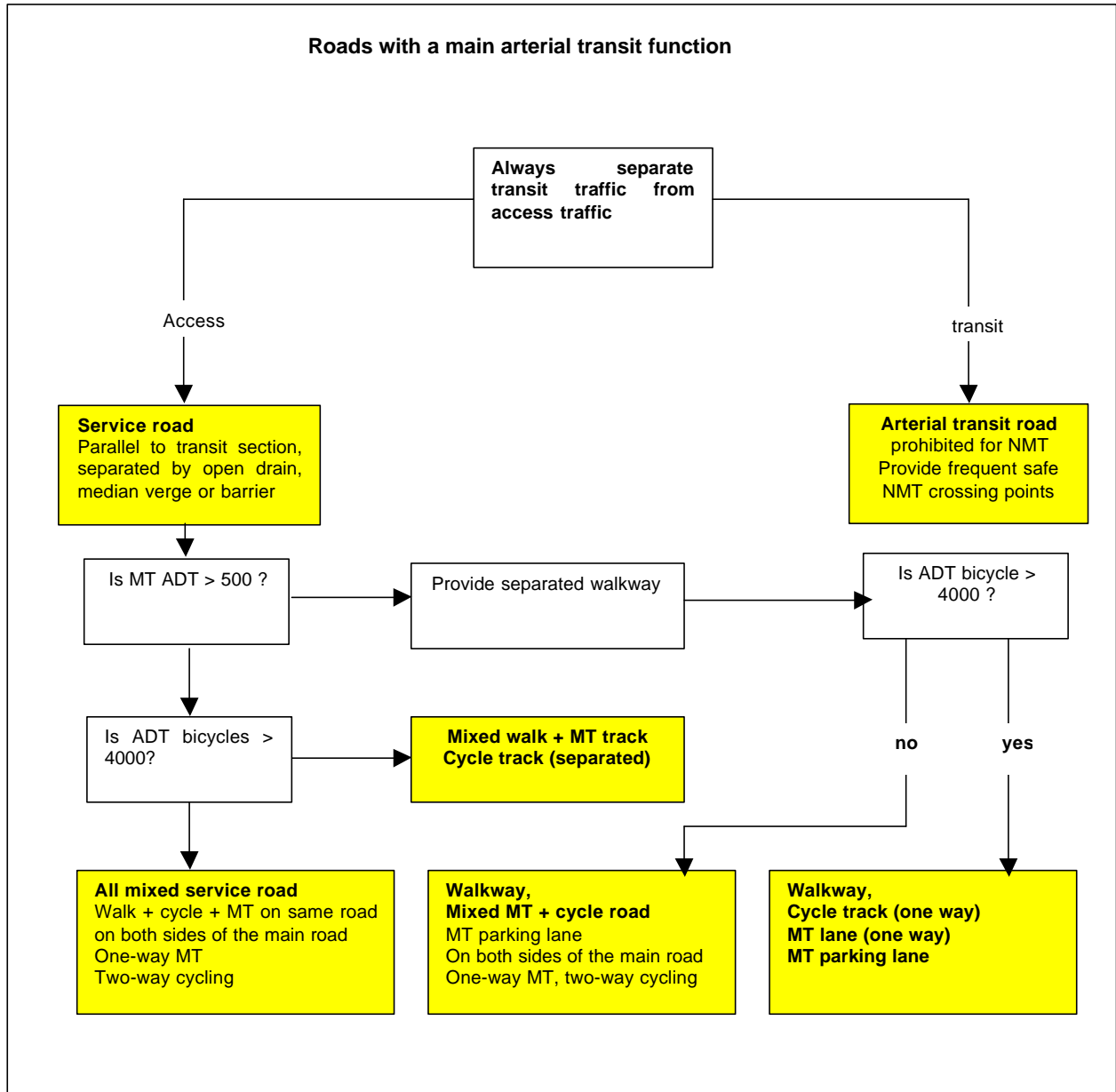
A similar hierarchy of roads can be made for NMT and would not automatically coincide with the one for MT.

Hereunder three decision matrices are presented, on which one can base his or her decision to integrate or separate. For this three matrices goes that first one has to identify the specific function of the road: access, arterial transit, or a mix between access and transit.<sup>25</sup>





<sup>1</sup> according to some experts, a bicycle track of just 1.5 metres is not sufficient in most of the cases. Only when volume is very low, and a road shoulder can be used in case of taking over another bicycles, such a width is acceptable. In the Netherlands a minimum width of 2 metres for single and 3 metres for both ways is usually applied. In case the track is shared with motorbikes an additional 0.5 metres is recommended. A bicycle lane of 1.5 metres appears to be no problem since one can swerve to the carriageway.



## 5.4 Infrastructure design

After having decided what kind of function a road will have in the hierarchical urban road network, the intended function might sometimes not coincide with its practical use. In next section we will elaborate on that.

### 5.4.1 Triangle of shape, function and use

The following approach (Figure 6) can be used for analysing a particular problem in traffic. As mentioned above, a planner has to design a road with certain ideas in mind about the road's purpose or functions for various modes, the shapes that go with it and its expected use. A function is not always been pursued by its shape, but usually by traffic regulations (signs) as well. There are several different functions such as access, distribution or transit for each kind of mode. Since the interest of various modes differ (and conflicts are lurking), the planner develops a functional classification of roads and road hierarchy is adopted.



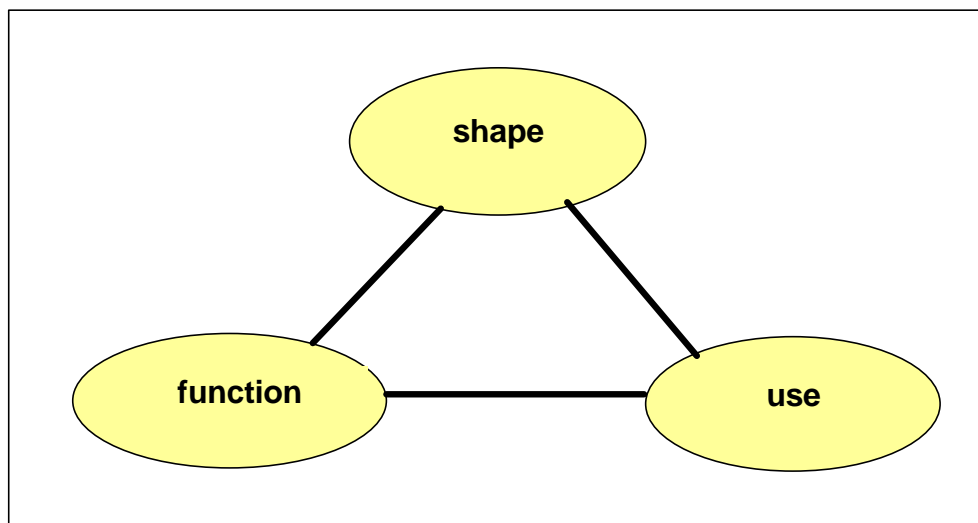


Figure 6 The triangle shape-function-use

Like function, the shape of a road can also change over time, e.g. by lack of proper maintenance or because of a reconstruction of the road. The third component is “use”, i.e. the actual traffic composition and behaviour plus all other activities carried out within the road reserve. That can be different from the intended one. If a traffic problem arises, there is an imbalance or incompatibility between function, shape and use. For example, bicyclists who are cycling on the main (collector) road might be forced to do so by parked cars blocking the bicycle track. Function and use have been mixed up. The easiest way to solve such a problem is to prevent cars parking on that track by adjustments in the shape of the segregation measure or enforce parking restrictions. Hereunder a set of interventions is given.

Table 13 Types of intervention to get a proper balance in shape, function and actual use

Type of intervention	Example
<b>Adjust the shape:</b>	<ul style="list-style-type: none"> <li>• build traffic calming structures</li> <li>• construct walkways</li> <li>• reconstruct the carriageways</li> <li>• place kerbstones to prevent parking</li> </ul>
<b>Influence the use:</b>	<ul style="list-style-type: none"> <li>• establish and enforce parking restrictions</li> <li>• relocate street traders</li> <li>• ban truck traffic</li> </ul>
<b>Change the function:</b>	<ul style="list-style-type: none"> <li>• provide other routes for transit traffic</li> <li>• convert areas into pedestrian zones</li> </ul>

## 5.5 Mobility improvement menus<sup>26</sup>

The pilot projects in the SSATP consisted of two interrelated menus of interventions for improving existing roads, i.e. pedestrian and bicycle facilities and measures for traffic calming. Two menus of interventions to improve existing roads are given below.

Table 14 Two menus of interventions used in the SSATP project

Menu	Type of intervention
Pedestrian and bicycle facilities	Walkways (1) Missing walk and cycle route links (2) Pedestrian crossings, combined with vehicle speed reduction (3) Physical separation between road shoulder and carriageway (4) Separation bicycle tracks on main bicycle routes (5)
Traffic calming	Raised zebra crossing (6) Speed hump (7) Intersection corner redesign (8) Pedestrian crossing island (9) Median (10) Narrowing with bicycle slips (11) Bus bays, combined with a raised crossing (12) Raised intersection of local collector roads (13) Low speed roundabouts at intersections (14) Short straight sections, or staggering (chicane) road axis (15) Carriageway narrowing (16) Road and road surface devices (rumbles, pinch points, signs)

### 5.5.1 Pedestrian facilities

Interventions to improve pedestrian facilities and safety do not obtain the full effect if these are randomly planned. Like with interventions for bicycles, a comprehensive approach should be followed, that is linked to urban planning and traffic strategies and interventions for other modes of transport.

Two sets of interventions should be put central (as mentioned in table above):

- Area-wide speed reduction or traffic calming schemes
- Provision of an integrated walking network

Whereas the first set of interventions is usually applied in residential areas, the second can often be found in town-centres (shopping areas, historical sites). Again, the way they should be applied depends much on the position of the road in the functionally hierarchical network.

#### Ad 1) walkways

Pedestrian speed in urban areas is generally low due to an absence of walkways, pedestrian congestion, bad pavement quality and waiting time for crossing roads. An average walking speed of around 3 km/hr is quite common. Average speed of walking can be improved drastically with low cost and efficient measures.

**Ad 2) construction of missing walk and cycle route links**

In the African pilot cities pedestrians and cyclists had to make significant detours to reach their destinations. Fenced plots, lack of bridges and nonnegotiable roads caused major increase in trip time. The construction of NMT-bridges over streams ranked high in all user priority lists; once constructed the bridges are widely used and appreciated.

**Ad 3) pedestrian crossings, combined with vehicle speed reduction**

In many cities pedestrians and cyclists face problems when crossing the road. A major share of fatalities and injuries among NMT-users is when they cross the streets and have a collision with a car or bus. High speed of the motorised vehicle and/or a sudden crossing at an inappropriate place is often the major reason. Solutions have to be established for both problems: i.e. traffic speed should be slowed, roads should be crossed at safe, clearly visible crossing points. **Raised zebra crossings, speed humps and pedestrian crossing islands** do reduce the speed of cars up to 30 km/hr effectively and provide pedestrians and cyclists safer means to cross roads. So far, the African experience shows us that concentrating crossing movements are difficult to realise. Therefore, attention to speed limitation turns out to be most important.

**Ad 4) Separation between road shoulder and carriageway**

An open road shoulder along urban roads increases the traffic accident hazards significantly. The grey zone along the shoulder where no barriers are constructed does create conflicts between various purposes: walking, cycling, trading, parking, overtaking etc. Facilities (bollards or concrete T-blocks) should be made at intersection corners, bus bays, speed humps and shoulders opposite pedestrian crossing islands and 25 m. on either side of a raised zebra-crossing.

Table 15 presents the needs of pedestrians with regard to walking facilities and crossings. These needs or requirements should guide planning and design of the facilities offered.

Table 15 Needs of pedestrians and imperatives for planning and design

Walking facilities	Needs of pedestrians:
	<ol style="list-style-type: none"> <li>1) Appropriate walking network enabling pedestrians to reach all their destinations.</li> <li>2) Shortest possible routes between two destinations, except in areas mainly devoted to leisure, commercial or cultural activities</li> <li>3) Choice between alternative routes for trips with different purposes (leisure and work trips for example).</li> <li>4) Continuity of routes (avoiding abrupt changes in the way they are planned and the amount of attention required from the pedestrians; remove obstacles).</li> <li>5) Adequate location of crossings (zebras, traffic light crossings, underpasses or bridges) in order to satisfy the two requirements: shortest route, continuity.</li> <li>6) Reduction of friction between motor or bicycle traffic and pedestrians wherever possible (segregated or separated pedestrian routes, or speed reduction).</li> <li>7) Good surface of pavement; wide enough to accommodate the volume/flow of pedestrians; shelters for bad weather or for waiting; adequate lighting; specific direction signs for pedestrians; resting facilities.</li> </ol>

<b>Crossing</b>	<p style="text-align: center;"><b>Needs of pedestrians:</b></p> <ol style="list-style-type: none"> <li>1) Adequate location of crossings (see above)</li> <li>2) Adequate time for crossing (long enough gaps between cars – traffic lights)</li> <li>3) Reduced waiting time for pedestrians to cross (through-traffic management measures)</li> <li>4) Reduced physical effort (as few underpasses or pedestrian bridges as possible).</li> <li>5) Possibility of crossing all along links with particular specifications (commercial streets, leisure areas): traffic management.</li> <li>6) Adequate mutual visibility of pedestrians and drivers on the approaches to the crossing (through planning of parking facilities).</li> <li>7) Reduced risk for pedestrians when crossing in the right place (design must ensure that vehicle users behave as expected).</li> </ol>
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### 5.5.2 Bicycle facilities

#### Ad 5) Separation of bicycle tracks on main bicycle routes

The authors of the guidelines state that safety is the major requirement for cyclists. Speed reduction has therefore top-priority. Separate tracks do solve the problem on sections, but not on intersections. Further, invisibility of the cyclists (not expecting or aware of a cyclists) is another field to work on. The best way to achieve visibility is by mixed use of the carriageway on most roads within the limits set out in 5.2 (segregation versus integration). Here we would like to focus on the various options:

#### **Bicycle lanes on mixed traffic roads**

When road capacity is a problem giving separate lanes to cyclists on a combined carriageway is the first preference. Speed level should be below 50 km/hr. At intersections enough space should be reserved for cyclists (crossing islands/medians). No tested example from the SSATP project is available.

#### **Mixed traffic service parallel to a transit MT carriageway**

The possibility of cycling along the major urban corridors is essential, to enable cycling throughout the city. Based on the experiences in SSATP, a.o. Dar es Salaam a mixed traffic service road along the main corridors appears to be most attractive in large African cities. As a side-effect one can see that the traffic on the main road is not obstructed. However, the barrier character of the road for crossing NMT will be enlarged.

#### **Separated bicycle- or NMT-only tracks**

A bicycle lane is no solution when speed of MT will remain high. Separated bicycle- or NMT-only tracks are a potential solution. However, still speed should be slowed down at intersections. The intensity of cyclists and pedestrians are factors to decide whether pedestrians should have separate facilities. The construction of a bicycle-only track without considering the pedestrians may result in a chaotic, ineffective solution because pedestrians will make widely use of the cycle path if there is no alternative. One should also identify whether the volume of cyclists is sufficient to avoid invasion of other users. Experiences in Africa (Ghana) and Latin America (Lima) have shown that too low volume of bicyclists can cause problems alike.

### 5.5.3 Traffic calming as an urban transport strategy

Though very little experience exists today about whether and how traffic calming interventions have to be adjusted to local African, Asian and Latin-American circumstances, one might conclude that these interventions have great potential. However, some experts argue that there is no win-win situation in general. Car driving will be less attractive and comfortable, braking and gaining speed again will cost extra energy and even lead to more emissions. However, if its main objective is to create a safe flow of traffic, and to reduce the number of accidents it is a useful strategy. Further, one can expect an increase in road capacity through higher intersection efficiency. Actually, this illustrates once more the necessity and importance of dividing the road network into a hierarchical structure (see section 5.3), and to incorporate NMT in an overall traffic management strategy. Doing so, one can establish three clear road domains and according measures: NMT, consisting of all access roads and tracks where MT is just partly allowed; mixed NMT/MT, consisting of collector roads where MT speeds are limited and the mix of cycling and MT is safe; and finally, the MT consisting of MT-only transit urban corridors.

#### **Ad 6 and 7) Speed hump and raised zebra crossing**

In the SSATP project various traffic calming measures are tested. The conclusion is that humps with precast concrete blocks (for slopes), a short flat top, and approaches with a strengthened foundation and brick pavement, work best.

On all locations with a considerable number of concentrated pedestrian crossings one should construct raised zebra crossings. The raise of an entire intersection (platform) is also possible. No tests are available from the SSATP yet.

#### **Ad 4) Separation between road shoulder or intersection corner and carriageway**

Open road shoulders along urban roads greatly increase the traffic accident hazards, since it does not delineate the functions; conflicts will arise between walking, parking, street trading, picking up passengers etc. A physical, visible separation between the carriageway and the shoulder largely eliminates the problem.

#### **Ad 8) Intersection corner reconstruction**

In Africa intersections have been designed according to highway standards (too wide). As a result speed is generally too high, causing accident hazards. Furthermore, the 'empty' space in the corner is occupied by street vendors or taxis, making the intersection more prone to accidents and congestion. A reconstruction of the intersection would increase safety by reducing car speed. A reconstruction of Y-shape into T-shape junctions also will limit car speed.

#### **Ad 10) Median**

Overtaking at an urban road (and using the opposite road side) is dangerous behaviour. The construction of median, preventing drivers to overtake, is an effective means of traffic calming. The median can also be used by a pedestrian when crossing the road. The need for this is bigger when it is a 2x2 lane road.

#### **Ad 11) Road narrowing with bicycle slips (bypasses)**

Road narrowing with bicycle slips or bypasses has two distinct advantages: it reduces the speed of cars and simultaneously channels the two traffic flows in a smooth way. The obvious disadvantage of a road narrowing without bypasses is that it may result in jamming cyclists and pedestrians. It is therefore important to create bypasses for cyclists to prevent this and to make sure that such bypasses will not be blocked (e.g. by parking cars).

#### **Ad 12) Bus bays**

The construction of bus bays can reduce the chaotic stopping of buses for passengers. This stopping and departing has a strong impact on safety, but also on traffic flow. Since they also regulate traffic flow in a better way, this instrument can also create a positive attitude of bus drivers towards traffic calming programmes.

## 5.6 The cost and benefits of various NMT- promotion measures

This section is split up into two parts. Firstly we will focus on 4 case studies at city level in which a cost-benefit analysis has been conducted. It has appeared to be the first of its kind. Therefore, assumptions may be sometimes questionable and need further research. However, the overall results will show the economic value of increased cycling. The second part consists of a number of tests conducted in the SSATP-programme for which a cost-benefit analyses of walking and cycling interventions have been carried out. This section concludes with some basic conclusions.

Annex 10 shows the methodology of Cost-Benefit-Analysis as it can be used for NMT. An adjusted methodology has been used in a Dutch study on the cost-effectiveness of a municipal bicycle policy in a small city in the Netherlands.

### 5.6.1 Cost Benefit Analysis of NMT-interventions in 4 cities<sup>27</sup>

The overall objective of the study carried out in 4 cities (Delhi, Morogoro, Amsterdam and Bogota) is to give an indication of the potential benefits of cycling interventions. The authors clearly did not pretend to have conducted a thorough scientific exercise, since time and budget were limited.

#### Amsterdam:

In the study the costs and benefits have been calculated for two sets of interventions, i.e. improving parking facilities for bicycles throughout the city; and improving the bicycle network, according to the proposals in the Core Bicycle Network Plan, resulting in high quality bicycle facilities on 7 important routes and quality improvements of all other routes of the core bicycle network. Table below presents the changes in total amount of trips and kilometres during evening peak hours due to bicycle policy.

Table 16 Changes in total amount of trips and kilometres for three modes of transport during evening peak hours (16.00 – 18.00 hr) due to bicycle policy, 1998.

	Trips (x 1000)			Kilometres (x 1000)		
	Bicycle	Car	Public T.	Bicycle	Car	Public T.
Actual situation 1998	102	219	138	335	4216	2471
Parking interventions	109	216	135	367	4200	2451
Network interventions	104	218	137	345	4212	2464

From this table we can derive that in the case of Amsterdam parking plays a more crucial role for promoting cycling than a further development of a network. Apparently, bicycle theft is an urgent problem and the cycling conditions are relatively good already. Extrapolating these figures for daily totals, an increase of 44,000 bicycle trips and a reduction of 131,000 car/kilometres can be expected.

The economic value of these changes can be calculated when looking at the reduction of parking places needed for cars (a saving of 16.8 million NFL per year); a reduction of pollution (a saving of 3.1 million NFL per year); a reduction of traffic accidents (a saving of 5.6 million NFL per year); a reduction of thefts (7.5 million NFL per year); a reduction in costs of health and absenteeism (7 million NFL per year) and time saving (15.3 million NFL per year). With a total cost of 120 million NFL over 20 years the overall CB is 1:1.5.

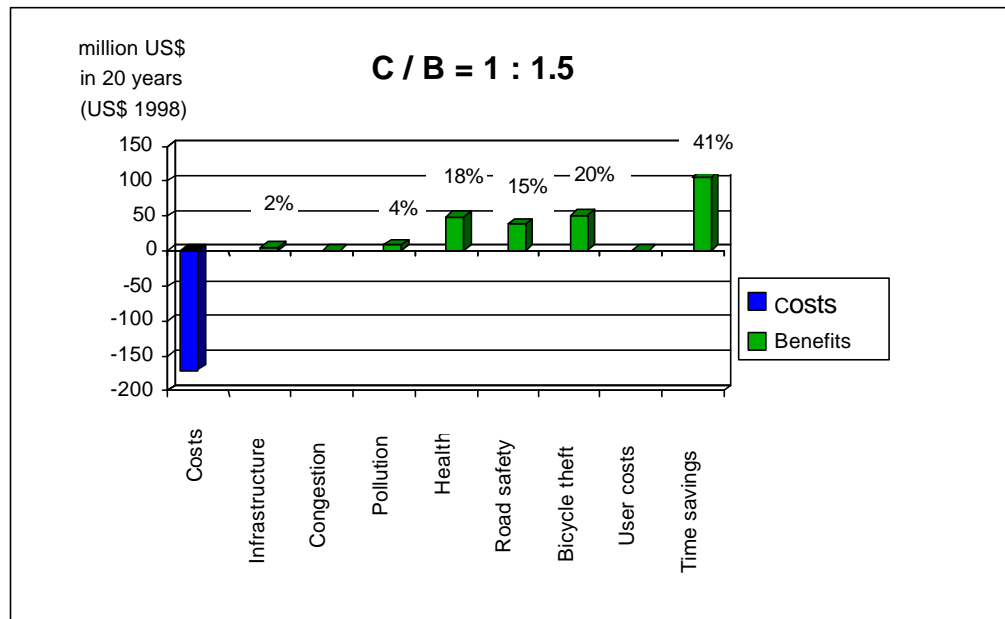


Figure 7 Cost and Benefits of 2 sets of interventions in Amsterdam, 1998

**Bogota:**

In this study the potential benefits of the bicycle master plan are estimated. The Bicycle Masterplan of Bogota consists of the construction of a 300 kilometres long route network, with a primary network of separate bicycle paths of 150 km and an equally long secondary network of other high-quality bicycle amenities.

For the calculations several assumptions have been made: the masterplan will result in an increase of bicycle use from 0.58% of total number of trips to 3-5% in 2009 (base year = 1999). With an autonomous increase in mobility of 2.5% per year, it will lead to 953,000 bicycle journeys per day in 2009; of these trips 843,000 are extra bicycle trips. Number of bus and car trips will reduce by 472,000 and 168,000 respectively.

The total costs of the bicycle infrastructure amount up to 186 million USD. The benefits are calculated as saved costs since not travelling by car. For the period 2000-2009 these amount up to 493 USD. The composition of savings is as follows<sup>28</sup>:

Less road maintenance:	0.05 USD per journey	14.1 million USD
Fewer parking places:	1.00 USD per journey	282 million USD
Less congestion:	0.26 USD per journey	72 million USD
Less pollution:	0.44 USD per journey	124 million USD

The savings on prevented accidents and on running costs for vehicles are the following<sup>29</sup>:

Traffic safety:	300,000 USD per kilometre	643 million USD
User costs (car):	0.175 USD per kilometre	105 million USD
User costs (bus):	1.95 USD per trip	62 million USD

The total benefits are thus 1,302 million USD. Therefore the CB ratio turns out to be 1:7.3. This ratio could have even be more positive as regards to cycling in case improved health and time saving would have been incorporated. Below figure presents the data graphically.

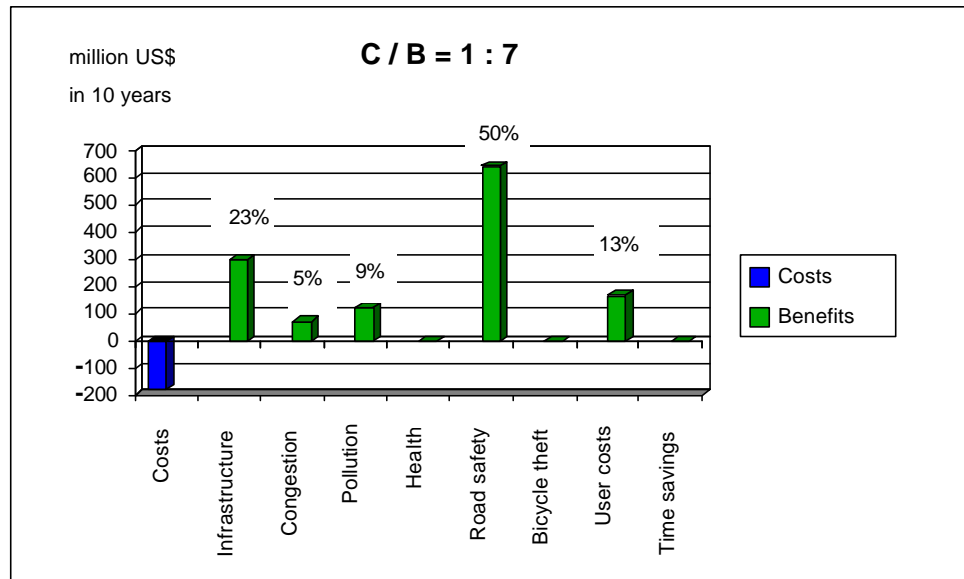


Figure 8 Cost and benefits of the Masterplan in Bogota, Colombia.

**Morogoro:**

The study in Morogoro primarily focuses on the savings of user cost. As will be presented hereunder, a Cost Benefit Analysis solely based on this user cost-saving component estimates that a pro-bicycle policy is highly beneficial.

The investments in safe traffic facilities consist of the construction of cycle paths and safe pedestrians crossings (40,000 USD per km) and of bicycle lanes with traffic calming measures (20,000 USD per km). The total costs are 1.3 million USD, i.e. 190,000 USD per year (10% interest rate, a 10 year depreciation period). Total annual cost (with maintenance) amount to 230,000 USD.

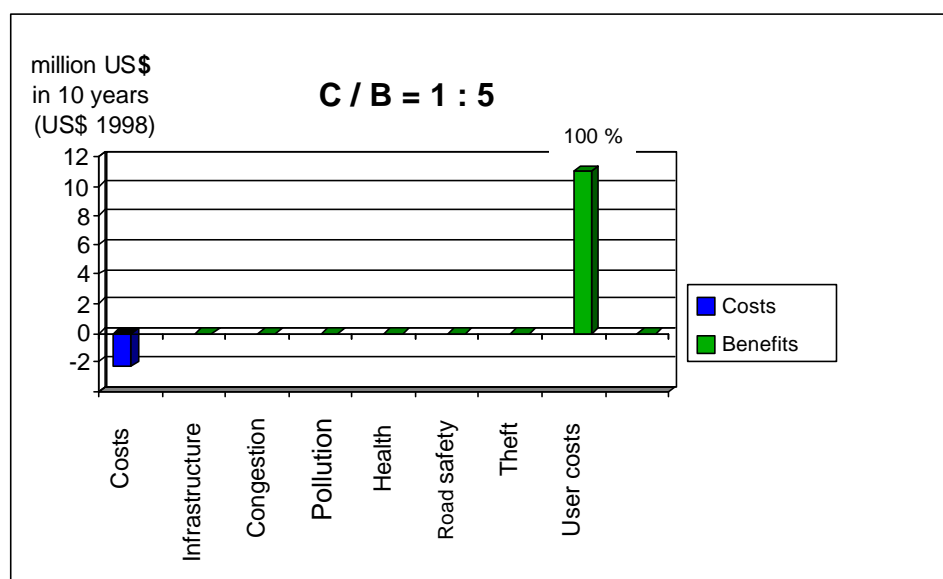


Figure 9 Costs and benefits of pro-bicycle policy in Morogoro, 2000-2010.



The current total costs for making a journey are about 14 million USD per year. 25% of these costs are related to travel time. The difference in travel costs between a-laissez faire and a pro-bicycle policy are 11 million USD in 10 years, assuming that bicycle use will increase from the actual 20 to 30% in 2010. These savings can be regarded as benefits. All other potential benefits, like savings on investments for motorised transport, environment, quality of life, traffic safety, increased mobility and employment are not considered. Even so, the outcome of the Cost Benefit Analysis shows a positive C/B ratio of 1:5.<sup>30</sup>

**Delhi:**

In the case of Delhi the cost and benefits of improvements on one representative stretch of the Delhi road network have been calculated. The improvements include a construction of a cycle path and bus lane. The upgraded road will be more efficient because present chaotic mix of different transport modes, including bicycles, leads to a reduction in capacity and speed. Further, a positive impact on bicycle use is expected since traffic safety has been increased.

The reconstruction will cost about Rs. 26 million per kilometre. Maintenance will be about Rs 2.6 million per kilometre. Depreciation period is 25 years for infrastructure, the discount rate amount to 6% per year.

The benefits will result from an improved traffic flow, accommodating 400 instead of 290 buses per hour in each direction, and 100% more cars per hour. Travel time will reduce significantly (50% for bus passengers and 30% for car and scooter riders). The average total travel time for MT will drop by 48%, which corresponds to Rs. 128 million per year.

For estimating the environmental and user costs, the study compares the situation where 7% of trips are made by bicycle with the situation that no cycling exists any longer in Delhi, due to safety and environmental reasons. Savings on user costs (fuel) and on costs of air pollution are Rs. 68.1 million and Rs. 14.5 million per year respectively.

Increased safety will lead to a cost saving of Rs. 3.7 million per year, based on Rs. 67,694 per prevented injury and Rs. 469,475 per prevented fatality. All this results in net present value of total costs of Rs. 121 million and a net present value of benefits of Rs 2444 million. The C/B ratio is thus 1:20<sup>31</sup>.

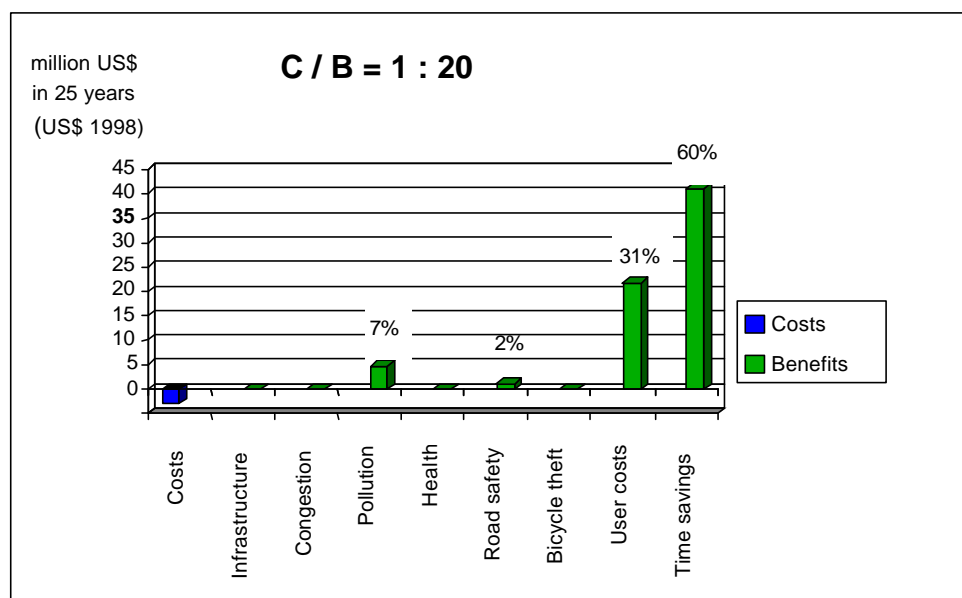


Figure 10 Cost and benefits of road reconstruction in Delhi.

### 5.6.2 Cost and benefits of the pilot interventions in SSATP

In the SSATP project a series of test interventions for improved walking and cycling facilities/infrastructure has been carried out. Its primary focus in these tests has been on speed reduction or traffic calming as well as increasing attractiveness of NMT. We refer to the guidelines for pedestrian and bicycle traffic in African cities, produced on by the WB SSATP for more details. Here we suffice with excerpts of some examples.

#### Walkway improvement along corridor:

The activities for improving the walkway were primarily focused on removing black spots in the walking routes. Comfort, directness and safety were improved. It had a very positive B/C ratio of 3.4. Actually, it could have been higher when other benefits (increased safety and comfort) were included as well.

#### Raised zebra-crossing in Dar es Salaam and Morogoro:

The study shows that zebra-crossing only make sense if they are raised. No positive effects were measured in the test with only a painted zebra-crossing. Improved safety however, has been the key effect of the raised zebra: no accidents happened after construction, whereas before 12 serious accidents occurred. The B/C ratio is 1.45 and only takes into account the accident cost avoidance.

#### NMT bridge in Dar es Salaam:

The construction of the bridge is a time-saving intervention. The detour (in case of no bridge) requires 15 minutes on average. The time-saving is set at 5 minutes. The total costs are then considered to be small: the B/C ratio proves that: 4:1.

#### Road shoulder separation MT – NMT in Dar es Salaam:

A 500 meter long section of a collector road with previously open shoulder was lined with T-blocks. The open shoulders often create chaotic situations, reduce capacity of the carriageway and damage the road pavement. After implementation the situation improved considerably. With regard to the value of the road shoulder, the test showed a one dollar increase per pedestrian per kilometre per year. It means that with an average daily traffic (ADT) of 1,600 one will break-even. Actual ADT is however three times as high! Further, the pavement is still in good condition and doesn't need any repair due to improper use of the shoulder. The costs saved on road widening (to increase capacity) are avoided. It appears that all benefit-components on itself would fully justify the investment.

Below, the findings are summarised in table form.

Table 17 An overview of the main costs and benefits of interventions tested in SSATP project

Test interventions	Total benefits	Benefit components	Total cost	Cost components	B/C ratio
Walk way improvement along corridor in Morogoro	14,400 USD (per year)	Saving travel time	18,000 USD 4,200 USD/py	Repair culverts Walkway construct. Build bridges	3.4
Raised zebra-crossing in Dar es Salaam and Morogoro	4,350 USD (per year)	Avoidance cost of accidents	4,500 USD per zebra-crossing 1,000 USD/py	Raised zebra-crossing	1.45
NMT bridge in Dar es Salaam	6,000 USD (per year)	Saving travel time	11,000 USD per bridge 1,500 USD/py	Bridge Cost reduction because community participation	4

Test interventions	Total benefits	Benefit components	Total cost	Cost components	B/C ratio
Road shoulder separation MT – NMT in Dar es Salaam	Unknown, but each benefit-component seems to justify the investment	Increased value of road shoulder Reduced cost of pavement maintenance Increased cap. of carriageway	1.6 USD per meter (per year)	T-blocks	?
Median in Eldoret (Kenya)	5,500 USD <sup>1</sup> (per year) 10,000 USD <sup>2</sup> (per year)	<sup>1</sup> reduction in costs accidents <sup>2</sup> Increase modal share of cycling	21,000 USD 4,500 USD (per year)	Median construction	1.2 <sup>1</sup> 2.3 <sup>2</sup>
Mixed NMT track along an urban corridor in Eldoret	7,000 USD <sup>1</sup> (per year) 15,000 USD <sup>2</sup> (per year)	<sup>1</sup> saving on bus fee <sup>2</sup> reduced costs of accidents	25,000 USD 5,300 USD (per year)	Construction of road „ crossing island „ speed humps Repair drainage culverts	> 4
Bicycle track along urban corridor in Eldoret	6,000 USD <sup>1</sup> (per year) 4,000 USD <sup>2</sup> (per year) 14,000 USD <sup>3</sup> (per year)	<sup>1</sup> Pedestrians gain <sup>2</sup> avoided costs of accidents cyclists <sup>3</sup> haltering reduction of bicycle use on this stretch	18,000 USD 3,900 USD (per year)	Reconstruction road High kerbs	1.5 4 to 5

#### Median in Eldoret:

The need for the construction of a median on both sides of a bridge in Eldoret was rather urgent. Car speed was far too high; dangerous overtaking was common; safety for pedestrians and cyclists was absolutely not guaranteed when crossing the road or using the edge of the carriageway. However, after completion the traffic safety was restored; vehicle speed brought down; and NMT volume increased. The B/C ratio turns to be 1.2 (in case one considers the reduction of cost of accidents only) and 2.3 (in case only the change in modal share is taken into account).

#### Mixed NMT track along an urban corridor in Eldoret:

The major purpose for this test intervention is to reduce the number of accidents as soon as possible. Speed appeared to be very high (max. 70-90 km/ph). By the construction of a separate track for cyclists and pedestrians it was aimed to increase road capacity of MT as well. The project turned out to be successful, but with unexpected results. Due to the limited capacity of the track, cyclists and pedestrians could not use the facility both. In fact, pedestrians claimed the track and cyclists used the carriageway. Still, as mentioned before, the results were positive: safety improved (no fatal accidents were recorded after completion of the track), the road capacity increased and attractiveness enhanced by eliminating those black (unsafe) spots. Therefore the B/C ratio exceeds even 4.0.

#### Bicycle track along urban corridor in Eldoret:

Irregular parking along the road, high speed of motorised traffic on the carriageway and obstructed go-through for pedestrians created problems concerning safety and road capacity. The test intervention aimed at smoother car-parking, unhindered walking on sidewalk and increasing safety and attractiveness for cyclists and pedestrians. Again, like in the previous example, things worked out differently. However, its effect, though unintended, is positive: the new bicycle track remains free of parked cars; attractiveness for pedestrians using the new track increased and so did safety for them. The cyclists still make use of the carriageway, but due to better use of the road, capacity and safety

increased. In Table 17 the benefits are given in case pedestrians still maintain the authority over the track (6,000 USD) and in case cyclists will capture the track (18,000). The corresponding ratio's of B/C are 1.5 and 4 to 5 respectively.

### 5.6.3 Promising results form the Cost Benefit Analysis

One of the authors of the first study presented in this paragraph, made the following three conclusions based on the CBA:

- Measures that **reduce MT driving speed**, especially in urban areas, will improve safety and in some cases mobility for pedestrians and cyclists;
- The benefits from **facilities for pedestrians and cyclists** exceed costs widely;
- Measures that **improve conspicuity and visibility** are cost beneficial. It improves the status of the bicyclists/pedestrians, makes him/her more recognised, and that will promote cycling and safety;

Moreover, the following conclusions can be derived from the test interventions in SSATP:

- The B/C ratio is high in case **black spots are eliminated**. The impact of prevented costs of accidents (fatalities, injuries, damage, congestion) appears to be very important;
- The **savings on bus fares** by using bicycles can have a significant impact;
- Investments in walking infrastructure do have similar (or sometimes even higher) C/B ratios as those in cycling infrastructure. There is **no reason to focus more intensively on cycling because of cost-efficiency**;

And more in general:

- In a city (like Amsterdam) where facilities are already up to a certain high standard, additional investments will have less impact than in cities without any, or very little money spent on NMT.
- Calculations have shown that when investing in bicycle infrastructure (compared to a MT lane), the total savings on infrastructure and trip costs are about 35% (1,600 USD) of total annual cost of bicycle infrastructure.
- The total costs of MT (infrastructure and operating costs) are 4 to 8 times higher than for bicycles.

## CHAPTER 6 IMPEDIMENTS, REQUIREMENTS AND OPTIONS FOR NMT PROMOTION

### 6.1 Impediments, requirements and options for further development of NMT

This section will go into more detail with respect to requirements or conditions for further development of NMT. Since the study embraces the demand-side approach we will focus on primarily perceptions of users and non-users. From data we can derive main factors that are negatively affecting the use of bicycles. Promotion of NMT should deal with these issues.

#### 6.1.1 Lack of traffic safety<sup>3</sup>

Lack of traffic safety which results in a high risk of getting involved in road traffic crashes is one of the major deterrents to bicycle use by a large number of people. In chapter 2, non-NMT-users mentioned it as the most important factor for not using bicycles in Leon and Arequipa (40% and 35% respectively).

In Table 18 some data on traffic victims is presented. Pedestrians and cyclists take in many countries a more than proportional share of total number of road users killed. The figure ranges from 2 up to 5 times the proportional share of total victims. With motorcyclists they belong to the group of vulnerable road users (VRU).

However, experience in countries like the Netherlands and Denmark show that the risks for cyclists to be killed can be reduced substantially. From the European research project 'Walcyng' it appeared that a larger share of cycling in the modal split correlates with a lower risk per kilometre cycled. So the present rather dangerous position of NMT should not be taken for granted, nor be used as an excuse for not promoting its use.

Table 18 Proportion of road users killed in various modes of transport as percentage of total fatalities (in %)

City, Nation (year)	Pedestrians	Bicyclists	Motor bikes	Cars	Others
Delhi, India (1994)	42	14	27	12	5
Thailand (1987)	47	6	36	12	-
Kathmandu, Nepal	43	9	13	36	-
Bandung, Indonesia (1990)	33	7	42	15	3
Netherlands (1990)	10	22	12	55	-
USA (1995)	13	2	5	79	1

<sup>3</sup> In a study by Gomez (2000), social safety is mentioned as the most important attribute to evaluate transport options. The reader is referred to section 2.5.2.

### 6.1.2 Requirement: improve safety

As has been shown in chapter 5, traffic calming measures and special facilities as cycle and walking tracks and lanes for pedestrians and cyclists improve their safety significantly. Additional measures as traffic regulations (speed limits) and laws on liability by traffic accidents<sup>4</sup> should be considered as well. The final choice of measures depends very much on the existing safety situation, function of road, and the volume and speed of traffic.

Though some experts claim that NMT promotion only makes sense when safety problems are tackled first, counter-arguments exist: there is no need to wait till safety standards are improved, before other promotional measures can be taken. Actually, the problem tree for cycling (annex 7) underscores this statement. From this tree we can derive that unsafety and invisibility are linked. Poor visibility and/or low awareness of other road-users on their turn are partly the results of low numbers of NMT-users. It leads to a conclusion that the chance of a fatal accident per NMT-user (especially a cyclist) decreases when more cyclists or walkers are using the road<sup>32</sup>.

Awareness raising and education/training of road users on traffic safety, especially related to NMT have an important impact on the behaviour of MT-users if combined with other initiatives including policing and design changes of vehicles and road environment. Generally, road safety education consists of teaching skills, knowledge, understanding of and behavioural patterns, to enable road users to prevent accidents. It takes place at primary and secondary schools, driving schools and at specific courses. Foremost, riding or driving skills are a precondition for safe behaviour since without that, no sufficient attention can be paid to safety. Knowledge about rules is the second precondition. People should learn how to apply these rules. Thirdly, rules have to be understood in the general framework of understanding traffic processes. Wittink<sup>33</sup> argues that especially practical training and exposure to traffic will learn children and thus future MT-users how to behave, instead of learning traffic rules. Rules for behaviour need to be internalised, i.e. their application should be a kind of reflex, with no need for conscious thinking about their relevance for the situation. In complex traffic situations decisions often have to be made in fractions of seconds. Besides, training of riders/drivers is already obligatory; but, unfortunately, issues concerning NMT-users and their rights are seldom dealt with.

Mohan comes in his proposal for effective communication with some astonishing results of educational campaigns that are challenging Wittink's implicit assumptions:

- 1) knowledge will not always improve people's behaviour; actually, it sometimes motivates them to do the opposite.
- 2) skilled riderships will not always enhance safety in traffic; actually, the so called driving experts endure more injuries than average.
- 3) information is not always available and easy to understand; in information campaigns the message is sometimes poorly presented (or even wrong) and therefor easy to misinterpret.

The ways to prevent or minimise the risk of such results are similar to the ones suggested by Saad<sup>34</sup>. Again, community participation will increase the chance of success. In the following box main requirements are mentioned for designing and implementing road safety campaigns.

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<sup>4</sup> In case of traffic accidents in the Netherlands between a motorised and non-motorised road user, the former will be held liable, unless he can prove innocence.

### Main Requirements for Effective Public Information Campaigns

The aim of road safety campaigns is to communicate information to road users, not only to enhance their knowledge about safety issues, but also to influence their behaviour on the road and to prepare them for new legislation or safety measures.

1. The choice of the topics for a public information campaign must be knowledge-based, i.e. based on accident rates and causes (especially those related to driving behaviour), and on general road user behaviour.
2. To ensure effectiveness one has to consider the actual situation, determine the desired situation and then how changes can be achieved. This way the purpose of the campaign can be decided, as well as target group and target behaviour, and establish assessment criteria.
3. Communication with road-users must be a two-way process. It is very important how road users interpret and receive a message, how their attitude and perception is of safety problems and actually what their understanding and knowledge is of regulations, rules and other road users. Further, it can provide insight in the psychology of the accident risk (fate / destiny or just wrong-doing by him/herself or other road users).
4. The selection of the means of communication will depend on the characteristic of the target group. Research in Niger has shown that for instance private and professional car drivers do have a very different background, socio-economic status, education level. Since the target groups are diverse, one needs to develop several communication strategies.
5. Evaluation of former campaigns is a must. It provides the communication expert information about the likely problems to encounter and the fields of improvement.
6. A safety traffic campaign must be part of a wider prevention policy and therefore related to other measures.

Various experts have stated that there is no better training of MT-users than let them experience the dangers and needs of cyclists and pedestrians themselves, by being one of them. Research has shown that when MT-users were or still are NMT-practitioners themselves, awareness and attitude are better. Furthermore, education seems to be more effective when a individual approach is used, more directed to the specific characteristics of the target group.

The expectations about the effectiveness of influencing traffic behaviour through campaigns shouldn't be too high. Various studies have shown that the direct effect is very limited. On the other hand, campaigns are a suitable instrument to get issues on the agenda and to create support for interventions that might result in the desired behaviour.

Therefore, information and education campaigns should never replace other measures, but be complementary to them.

A starting point for improving safety can be an analysis of the existing safety situation, a so-called safety diagnosis<sup>35</sup>. Lassarre and Muhrad provide a framework for better targeting safety actions and designing optimal solutions. Their methodology comprises of:

- a) statistical accident analysis,
- b) in-depth accidents analysis and
- c) complementary investigations to understand better the accident factors, especially the behavioural ones.

Part of these investigations can be directed to public opinions and attitude towards safety and safety measures. This safety diagnosis can be adapted to each different

level of intervention (i.e. urban areas – city – route – particular category of road network – neighbourhood – blackspot). The way of accident registration turns out to be not uniform (standardised), reliable and complete which makes it not only difficult to measure actual progress within the city or country, but also to compare between countries. The impact of measures will be therefore difficult to assess. A clearer, standardised form (which allows adjustments however) and in which use police officers are properly trained, is recommended. A further co-operation between the police, researchers and decision-makers should be promoted.<sup>36</sup>

### 6.1.3 Bicycle theft and lack of parking facilities

In the local background studies<sup>37</sup>, theft has been identified as an important deterrent factor. These comparative studies show that in all cities under review, theft is a significant and increasing problem. A household survey in 1995 reveals that in Gangzhou 3 bicycles were stolen on average per household in a time-frame of three years. A total of 3.4 million bicycles were missing in that same period. This finding is supported by new data indicating that 1,703 bicycles were stolen from 470 households during the last 5 years, an average of nearly 4 bicycles per household. The other cities are experiencing the problem of theft to a lesser extent: in Accra, Leon and Delhi respectively 17%, 20% and 28% of the interviewees had their bicycles stolen for at least one time. The effects on bicycle use are significant, since a considerable number of cyclists (up to 30% in Guangzhou) said they would stop cycling after getting their bike stolen. Low percentage of bike recovery (not more than 10%) and unwillingness of police to register theft probably support the idea of not buying another bicycle. These findings are very much in line with similar findings in Amsterdam, the Netherlands: bicycle theft is for many people a reason for not owning a bicycle or for using it less than desired. A significant number of people replaces the stolen bike with a poor quality bicycle.

Thieves are generally not scared off by the vision of locks. Nearly all bicycles in the study that were stolen were locked and sometimes even parked in a guarded parking facility. However, parking facilities have turned out to be a rather good means against theft. Unfortunately, most cities do not have proper parking facilities: neither location, nor price is usually convenient for the bike users.

Bicycle registration (at least, without effective control) turned out to be not a successful tool against bicycle theft as shows the case of Guangzhou. In Jiangmen City, where a new bicycle number plate practice is in place, results are different. First reports about the movable plate have been positive: police recorded a substantial decrease in thefts. The reasoning behind a bicycle registration system is that it would enable the police to identify stolen bicycles or to confirm rightful ownership. The condition for this however is twofold: the system should be set up in a way that regular checks are easy to do; and secondly, the police should put effort and time in actually executing these checks. In practice these conditions are not easy to fulfill.

From all studies and the experience from the Netherlands we might conclude that parking the bicycle in guarded parking facilities prevents theft best. At one of the very few places in Lima where you can park your bike, i.e. the Catholic University, students have to show their ID before entering the university compound. So far, no single bike has been reported stolen. Rather few bicycles were stolen out of guarded parking facilities in Guangzhou. The best and most economic location for a parking facility is at major destinations (stations, markets, offices etc). The establishment of guarded parking facilities might turn feasible, especially when such a facility will have a multi-functional purpose, for instance bicycle repair shop or kiosk.

A second best and very practical solution is to have solid bicycle parking facilities offering the opportunity to lock the bicycle to the facility. Such a provision is particularly relevant for destinations which do not attract enough numbers of cyclists, or where visits are too short to justify guarded bicycle parking. Besides, these bicycle parking facilities provide a reasonable solution for those cyclists who are reluctant to pay for guarding or find proceedings too time consuming.



Table 19 Bicycle theft and location in cities under survey (in percentages)

Location of theft	Accra	Delhi	Guangzhou	Leon	Lima
Residential area	24	n.a.	62	26	n.a.
Office	8	n.a.	5.1	11	n.a.
Market place	16	n.a.	33	16	n.a.
School	-	n.a.	-	7	n.a.
Other place	52	n.a.	-	40	n.a.
Total	100	n.a.	100	100	n.a.
Theft cases <sup>1</sup>	17%	38%	99% <sup>2</sup>	20%	26%

<sup>1</sup>Percentage of respondents having their bicycle stolen at least once.

<sup>2</sup>Assumption: 1703 bicycles were stolen from 470 responding households during 1991-1996, which means that on average 99 bicycles were stolen from every 100 people (including non-bicyclists).

#### 6.1.4 Requirement: prevent bicycle theft and offer parking facilities

Theft is an important deterrent to bicycle use. The prevention of bicycle theft is considered to be an effective tool to stop people switching to motorised transport or to promote wider use of it. Facilities such as guarded parking lots need to be positioned at more suitable places (major destinations) against more reasonable prices. Local governments should incorporate these facilities in their land use plans. They might financially support employers and shops by subsidy, reduced VAT on construction etc. when providing guarded parking facilities.

The financial feasibility of these parking facilities can be improved when other services like bicycle repair, bike rent, or even kiosks/small shops can be offered or established.

The quality and availability of locks should be improved. However, one should bear in mind that so far no bicycle locks exist that are fully theft-proof.

A more active approach by the police and authorities against theft and receiving would help to scare off potential thieves and buyers. The Chinese case has shown that it has a relatively great impact. In many countries victims were frustrated by not getting their stolen bicycle even reported.

#### 6.1.5 Lack of proper infrastructure

Often, bicyclists and pedestrians can not use suitable and safe paths or roads to move. In Asian countries, where NMT has been dominant, the emergence of the private car and motorbike has deteriorated the position of NMT significantly. Even in such a speed that in some cities it hardly exists anymore (Bangkok) or is diminishing quickly (Ho Chi Minh-city). In the case of HCM-city, the roads (formally constructed to accommodate NMT) are used by various means of transport now. Bad driving behaviour of MT-users, lack of traffic regulations and enforcement, and total lack of NMT facilities make it extremely dangerous in a city, where 15 years ago hardly a motorbike or car was seen.

Guitink illustrated<sup>38</sup> the issue of urban density and use of NMT (especially bicycles) with 3 different examples:

- American cities: low density and therefor long trip distances;
- South-east Asian cities: high density; any increase in car use will inevitably have a negative impact on bicycle use (NMT will be pushed off the roads);

- European cities: 'optimal' density; there is enough space for bicycles, pedestrians and motorised vehicles to exist simultaneously.

In some Asian cities one can see that just a relatively small group of road users (MT) is dominating or monopolising the road or urban space in general.

During the TRB in 1998 a comparison was presented about accommodating car traffic in European and American cities versus Asian cities. It was argued that for more than 80 years European and American cities have tried to adjust these to the use of cars with just limited success. It is beyond imagination that Asian cities could accommodate the same level of MT within 10 years, nor the money, nor the space is available to do this<sup>39</sup>. It once more illustrates the unlikely success of the transport policy of these cities.

As shown above, in case no facilities are offered, cyclists and pedestrians are vulnerable road users. In African countries, where walking still remains the most important means of transport (due to captive usership), lack of proper infrastructure limits further growth of NMT or even possibilities to sustain actual levels; in these countries, a switch from walking to cycling induced by an improvement in income won't occur if roads are in an appalling and bicycle unfriendly-shape. Income loss due to the time-inefficiency of walking will be the inevitable result.

#### **6.1.6 Requirement: provide infrastructure and facilities**

The provision of adequate infrastructure to NMT users, pedestrians as well as cyclists, has an immediate impact on the use of bicycles. Its impact however can not be measured by just counting the number of people using the new facility, since they might have changed their routes. Surveys have unambiguously pointed out that when improved walking and cycling facilities meet the requirements of safety, directness, coherence, comfort and attractiveness more people will walk or cycle (or the decrease will be stopped). Chapters 3 and 5 have explored extensively about the effects of these kinds of interventions. The reader is referred.

#### **6.1.7 Taxes, fees and procedures**

Some governments discriminate fiscally against NMT. For example, in Africa the diminishing stock of bicycles (and so high prices) has partly resulted from high taxation on bicycle imports. Bicycles were treated as luxury items. Markups on boarder prices have ranged between 200 and 500 percent in Tanzania, Ethiopia and Ghana.<sup>40</sup> High taxes have been mentioned by 10% of the non-cyclists in the Leon case study as a major deterrent (whereas these interviewees mentioned "roads in disrepair" in just 2% of their answers). Since bicycles (especially in the case of Africa and Asia) are generally used by the poor, it is very illogical to tax them as luxury items; even more surprising is that these same governments refer to cycling as a backward, old-fashioned way of moving, not belonging to a modern city.

In a number of countries, a.o. Nicaragua, China and Tanzania bicycles have to be registered. In the case of China this has been explicitly implemented to reduce theft. However, in other cases the registration requirement is part of a strategy either to limit the growth of people using a bike, or to generate additional income for the local bureaucracy. It is found that in some cases the bureaucracy is keener on pursuing the collection of registration fees and road taxes from cyclists than from car-owners.

#### **6.1.8 Requirement: remove procedures and registration obligations**

In most cases, the procedures and registration obligations of bicycles perform the function of income generation for officials or as a demotivator for bicycle use. The abolishment of such procedures might be part of a process of good governance and administrative reform. However, China appears to be an exceptional case. The frequent

theft of bicycles is said to be halted after implementation of a new number (registration) plate of metal that is attached to the bike.<sup>41</sup> It is highly doubtful whether such a strict and demanding approach can be implemented in other countries as well.

### 6.1.9 Unaffordable prices and fees for urban poor

Due to the high taxes on imports, prices at the local market are equally high. However, since China and India are huge producers of affordable bicycles, the development of a local bicycle industry in other countries remains difficult. Various efforts have been made, but these turned out to be not viable and competitive once trade liberalisation was introduced. Even in the case that prices are reduced, bicycles might still be out of reach for the majority of the poor. Though poor households might save a considerable part of their income (no need for renting bicycle, buying a bus ticket, and saving time), the purchase of a bicycle is still a “big” investment. The World Bank (1994) calculates that a bicycle costs 7 months average income in Uganda, ten months in Malawi and Tanzania and over three years income in Ethiopia<sup>42</sup>.

Looking from another angle, we might state that there is a significant bias towards MT-use and to richer sections of society. The external costs of car use (air pollution, congestion, and administrative costs of accidents) are merely transferred on society as a whole. Not incorporating these external costs in car use charges should be seen as an implicit subsidy. Furthermore, prices of petrol are in many countries far below the international price (and are thus a subsidy): for example, in Vietnam a litre of petrol is just 4,000 VND, equal to 0.30 USD (mid-2000).

A subsidised public transport system to increase the mobility of the poor, is not helping them very much either. Again, since such a programme is in most cases an indiscriminate policy, it helps the middle and higher income classes more than the poor, who still can not afford the price of a ticket. Making cycling more affordable, even when this would be detrimental to tax-income of the government, might save money for society. It may take away the need for additional investments in road infrastructure for MT and public transport.

### 6.1.10 Requirement: make bicycles affordable for the poor

The use of bicycles, as previous sections have shown, is dependent on various factors. Though between bicycle ownership and use there is not a clear-cut positive link (countries with a high number of bicycles per capita don't cycle often that much) the author of this report is convinced that lack of money for the purchase of a cycle is a limiting factor. As the Dutch case has shown, an increase in income per capita has made the bicycle a popular means of transport, accessible for the majority of the people. In the African case studies a similar picture reveals. To overcome this problem several options can be identified:

- **A credit programme** directed to the poorer sections of the urban population. The World Bank has provided funds for such a scheme in for instance Lima (Peru). Unfortunately, when the credits had to be released, no credit mechanism for clients without assets was in place at the Municipal Bank of Lima.
- An incentive programme for employers to establish **credit and savings schemes**. The African pilots market conditions and attitudes turned out to be unfavourable to credits pre-financed by employers. In Eldoret (Kenya) good results were achieved with a saving programme for the purchase of bicycles for its members.
- **Bicycle sale-on-credit-programmes** have got a lukewarm reception in the pilot projects in Africa since it proves to be too risky for a shopkeeper to loan to poor clients this way.
- In Morogoro (Tanzania) the project experimented with **bicycle lease contracts**. It was said that the idea received a positive welcome by bicycle hirers. However, the

renter's financial situation was too weak at that time to allow them to pre-finance enough bicycles.

- The scheme for **promotional bicycle sales to women and children entering secondary school** was quite popular. It shows that women are an important potential target group (less than 5% of the cyclists is female in Morogoro). It shows that price-elasticity turns out to be high: a reduction of the price will lead to significant more bicycles sold.
- A local Government in Belgium has announced very recently (August, 2000) to **pay a monthly 20 USD premium** to their employees if they make use of a non-motorised means of transport to come to work.

## 6.2 Stakeholder participation

### 6.2.1 Stakeholder participation: key to success

User/stakeholder participation has been mentioned as the key to success in all discussions and reports consulted. A lack of participation by users and other stakeholders will definitely lead to a weak and unsustainable result of interventions undertaken. Planned and implemented activities will not be understood and may even harm the interests of bicyclists. In cases of lack of participation during the design and planning, bicycle lanes and paths quite often lead from nowhere to nowhere, are hardly used by cyclists or are used by others (motorbikes and cars, pedestrians, people who dry or stall their products).

The major and most-sustainable motivation of people to join efforts in improving urban mobility is self-interest. Saving travel time, increasing safety, reducing costs and improving accessibility are often heard reasons to support actions. If interventions will certainly harm their interest, little co-operation might be expected. To overcome the resistance one might try to convince the partner with sound arguments, or compromise so that the major disadvantages are shared or removed. One can also decide to compensate the disadvantaged partner. Looking for "win-win" situations, where nobody loses, is often the key to success.

In general, the advantages of participation (besides avoiding the problems mentioned above) are the following:

- It smoothens the execution of interventions since fewer objections/court cases from citizens will occur and wider acceptance is secured. All layers of society should be represented in order to prevent biases that will harm the poor and less-powerful.
- It improves the quality of the decisions since local know-how and experiences of users and professional expertise are combined. Users are often in the best position to identify urgent priorities.
- Potential future problems might be identified earlier and solved quicker since there is wider support.
- Sharing of responsibility and costs solves the financial and organisational burden of the government – stakeholders become more pro-active actors. But one should bear in mind that private investments can only be obtained when there is a realistic expectation of tangible benefits.

Tembele<sup>43</sup> describes the requirements for user participation. They sound simple but are unfortunately seldom met:

- Mutual trust between community and government
- Early implementation of at least some of the prioritised interventions
- Localising user participation, i.e. concentration on relevant, close-to-home problems
- Open user platform membership, so to include the groups that are often neglected
- Transparency by making all information, priorities, strategies and actions openly available to and known to all stakeholders.

- Accountability by sharing in decisions.
- No association with political parties
- No personal financial benefits for joining a user platform

Experience in Africa shows mixed results: in Tanzania the results are positive, in Kenya the success is much lower. Main reason for this is the lack of commitment of the Kenyan authorities to allow for real participation. From that same source of experience it became clear that the strength of participation depends mostly on the urgency of the problems and the expectation that the outcome of the entire process will in fact be positive for the user group involved. In the NMT-project in Lima the level of participation is nihil. Only after protests of people some ad hoc meetings were organised. Staff and authorities were not aware of or committed to real participation.

User's participation is for another reason important. During the planning process they are likely the only ones with real at hand cycling experience. Planners and decision-makers are hardly aware of the cycling problems.

**Different forms and roles of user participation: general user groups, general user platforms and local user platforms.**

Depending on the phase of the project cycle user participation will have different shapes. Good results were obtained in the SSATP when firstly a wide range of user groups were identified and contacted, secondly a general user platform was established and finally local user platforms for all packages of interventions were formed.

Initially, **user groups** may focus on identification of problems with mobility and NMT. A convenient tool for this is a focus group discussion. In Dar es Salaam 64 user groups were formed with about 10 people and focus group discussions were held. The broader the approach, the bigger its future support. These focus group discussions can provide planners information on problems, road use behavior, potential solutions and priorities.

A **general user platform** for the whole area can review, articulate and prioritise the problems mentioned by user groups. More specific, the platform will articulate and inventory important mobility, accessibility and safety problems in the area. The platform can identify with the professionals solutions and prioritise these. Such a platform consists of about 20 non-political, non-governmental citizens who will act as an intermediary between the authorities and the community.

Thirdly, **local user platforms**, as in the pilots of the SSATP, can be formed. They turned out to be most successful innovation in that pilot project. Their tasks may include planning, reviewing plans and proposing changes, control during construction, mobilising resources, organising repairs etc. Mobilising own funds, as shows the Yombo-bridge case in Dar es Salaam, works best when users are informed adequately of the costs involved in the project.

In special cases one might consider **user associations** when permanent attention should be paid to certain infrastructure or facilities. In the case of Dar es Salaam a garden park was planned to be handed over to a user association for maintenance and protection. Such a user association would have a legal status and can mobilise finances through contribution of members or users.

With all this, it is the government authority that through assignment of staff, initiates and enables such a process of participation. Further, the authorities can contribute in making decisions promptly and in allocating the required budget. In the following table the above is summarised schematically.

Table 20 User participation institutions and potential role in NMT projects

Model:	User	General user	Local user	Awareness campaign	User
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Importance of :	group	platform	platform	and publicity	association
Giving public information about all project activities	+++	+++	++	+	+
Listening to user problems and discussing with users	+++	+++	+++	+	+
User participation in analysing problems and setting priorities	+	+++	++	0	+
User influence in decision making	0	+	+++	0	+++
Attempt to change user behaviour	0	+	+	+++	+
User initiative to implement their own proposals	0	+	++	0	+++
Private implementation and/or management of public infrastructure by users	0	0	+	0	+++

### 6.2.2 Lessons learned from the African case study

Below a list of lessons learned from the participation process in Tanzania and Kenya is given. One should be aware of the variation between these countries and even cities. However, the authors came to the following generalisations:

- Communities are able to develop their own priorities, work out solutions and arrange for implementation.
- A strategy that concentrates municipal support on the priorities developed by the communities has a better chance of succeeding.
- People's commitment and enthusiasm is at large when interventions are close to his/her individual environment.
- Being open about project costs contributes to the credibility of municipal staff and increases the willingness of citizens to mobilise their own funds.

### 6.3 Organisational requirements for local NMT interventions

In their report “Guidelines for Pedestrian and Bicycle Traffic in African Cities” the authors come up with a set of organisational conditions for increasing the chance of success in a municipal NMT project. Hereunder the somewhat revised major conditions:

One should consider the following:

#### Team composition:

1. The municipal team should be multi-disciplinary and inter-departmental composed of a social scientist, planner and an engineer.
2. Selection of the gender balanced team should be based on proven past commitment and quality. A national advisory group of independent experts should be established.

#### Mandate and tasks:

3. The team should have the authority to take initiatives, plan and implement interventions.
4. The municipal government should fully support and commit herself to the cause of NMT.
5. Disciplined internal team work-planning and progress control

#### Choice of activities:

6. The team should support intensive user participation in planning and design process.
7. Team’s focus should be on widely supported interventions with a high benefit/cost ratio (value for money).
8. Implementation at an early stage of the first activity should be sought for. Planning without implementation creates negative effects among the public as well as within the municipal organisation.

#### Monitoring:

9. Intervention effects should be carefully monitored.
10. Independent technical and financial audit of interventions should be in place, with user representatives on the audit committee. Openness and transparency in planning and reporting are required.

#### Budgeting

11. A realistic project implementation budget should be drawn up. It is better to start small at a manageable scale.
12. Budget for next interventions should only be made available after successful completion of previous tasks and strict financial and technical control.
13. In case of international financial support:
  - a) International loans for urban renewal activity with a large number of small components, trigger a complicated process involving many parties that are remote from the issue at hand and involve excessive indirect costs. Therefore it is recommended that, grants should be released step by step, to control the excessive indirect costs.
  - b) Partial financial support for intervention costs so that counterpart has to show commitment. The requirement of allocating local funds for intervention measures makes future allocation more likely and can ensure that the right priorities are made (and not just the ones of the donor).
  - c) No or just limited control by foreign agency in the planning and implementation process to improve sense of ownership and responsibility.
  - d) Allowances should not become a project target.

## CHAPTER 7 OBJECTIVES AND STRATEGIES FOR INCREASED ROLE OF NON-MOTORISED TRANSPORT IN URBAN ECONOMIES

### 7.1 Introduction

In this chapter we will elaborate on the three overall objectives or principles that should be the start of any strategy or plan of interventions: improved quality of life, economic growth and poverty reduction. The authors believe that NMT can contribute significantly to the aforementioned objectives. Hereunder, we will explain why. To achieve these objectives, we have worked out a set of strategic issues that should be covered in any comprehensive programme to support NMT.

In previous chapters we have explored the opportunities for a more effective policy with regard to NMT, basing on literature study and interviews. We do realise that the recommendations are based on a relatively limited number of cases. Further experimenting and research on the influence of (differences in) local circumstances on the effectiveness of NMT policies is recommended strongly.

### 7.2 Three objectives: Improved Quality of Life, Economic Growth and Poverty Reduction

#### 7.2.1 Quality of Life and Economic Growth

The Bank has committed itself to improving quality of life of people. At various occasions the Bank has shown its commitment to NMT too, since it believes that NMT can contribute to more liveable and productive cities. If quality of life is the denominator of aspects of household income, clean environment, health, attractive cities to live in and easy physical access to essential services NMT can play a significant role. In the following sections NMT's contribution to the economy and quality of life (including health, safety, accessibility, employment and environment) are dealt with. In section 7.2.2 we focus on NMT's value for poverty reduction.

Cities are the engines of economic growth in developing countries. The urgent mobility problems in most of the big cities in these countries are hampering further growth to an important extent. The costs of urban congestion for cities like Bangkok, Manila or Bogota and many others are impressive. In their study "The Economic Significance of Cycling" Buis and Wittink<sup>44</sup> have elaborated on the theme of economics. Investments in NMT are sound and economically attractive. Below, some insight is given in their argumentation. The authors identified 8 aspects that contribute or are related to economic growth and quality of life.

**Accessibility and use of space** are two fundamental economic aspects to which bicycles can contribute in a positive way. It is quite ironic that with the increase of faster transport means, the average speed in cities is diminishing. Surveys in the Netherlands reveal that trips in cities shorter than three kilometre are best made by bicycle from the perspective of time. In cities where motorised traffic is slow (Bangkok = 8 kph) an



important time-saving effort can be made by travelling on a bike. Major contributor to congestion is the car, which occupies expensive and scarce urban space. The parking-ratio for cars and bicycles is 1:10; the maximum road capacity-ratio is striking as well, i.e. 1:4 (some experts argue that this is a rather conservative estimation; according to them 1:20 is more likely). All in all, Bangkok is missing out one-third of its economic growth due to congestion (1.8 Billion US\$ per year). Investments in transport modes requiring less space (public transport, bicycles, walking) seems therefor justified since it will reduce the problem of congestion and improve the economic productivity of cities.

The reduced accessibility of the inner-city has had indirectly major consequences for its **attractiveness and quality of life** for companies and people. Due to that, major social and economic problems have arisen: a vicious circle of unattractiveness occurred: crime, unemployment, deteriorating infrastructure, closing shops and leaving inhabitants. Improved public transport, pedestrian zones, improved cycle facilities has helped to halt such a process. The Brazilian city of Curitiba with good public transport and bicycle facilities in a healthy environment is attracting now big international companies. It shows that a sustainable and attractive transport system pays off its investments.

**Safer traffic** is another economic aspect of bicycling. While the number of fatalities in traffic in developed countries is declining, the number is exploding in most of the developing countries. Among the deaths, cyclists and pedestrians take a major share. Therefor less and less people chose to cycle and switch to other modes, which in itself makes it even more dangerous for people who continue to cycle. Results show that after implementation of bicycle plans in Amsterdam and Graz (Austria) for instance, fatality rates dropped due to bigger awareness of other road users, segregated cycle paths and speed limits for motorised traffic. Further, safety levels are highest in countries in which people cycle most. On average 2% of GDP is spent around the world on the consequences of road accidents. The costs of road casualties in the Netherlands amount up to more than US\$ 5 billion per annum. The European Union considers a fatality an economic loss of around US\$ 1 million per year.

Cycling has an important contribution to city's **employment**. A high level of bicycle use generates a demand for bicycles and parts, and services such as repair, rent, and paid parking. The Dutch bicycle industry has a turnover of US\$ 1 billion annually. The bicycle production industry in developing countries is underdeveloped. China and India are important bicycle producers and compete internationally with local producers. Since local markets are still small most countries will rely on imports. A drop in price (import levies or VAT) will stimulate the purchase of bicycles; the price-elasticity for bicycles namely has turned out to be high. Afribike – a South African Bicycle Promotion Organisation – has so far positive experiences with a franchising package, in which producers/assemblers, sellers and credit experts co-operate. Besides, other industries will also benefit from NMT development. Small entrepreneurs can widen their action-radius and market for their products through increased mobility; as a consequence, their economic activities can develop.

Considerable **public savings** could be made when investments in bicycle infrastructure make investments in car infrastructure unnecessary. So far, investments for bicycle infrastructure are nullified by those for public transport and cars. For reasons of efficiency, as shows the case of the Dutch city of Dordrecht, one has to consider investments in cycling infrastructure: to deal with increased demand for mobility two scenarios were developed. The first scenario focused on widening the existing public roads to increase the car capacity. The second scenario focused on constructing new cycle paths and four cycle tunnels. Nonetheless, the costs of the second scenario amounted to just 75% of the cost of scenario 1. When one would also consider the costs for building parking lots in the inner-city, the second scenario would even been more beneficial. In Bern (Switzerland) three scenarios were worked out; a trend scenario in which car traffic is not restricted, a public transport scenario and a bicycle scenario in which major emphasis lies on bicycle investments. It shows that the trend scenario turns out to be the least expensive, whereas the public transport scenario the

most expensive one. However, when external costs are taken into account (casualties, environmental pollution) the bicycle scenario - with increased costs for public transport and cycling - turns out the least expensive solution to cope with increasing mobility.

The transport sector is a major source of **environmental pollution**. In most urban areas, motor vehicles are the most important source of air and noise pollution. It is a main source of carbon monoxide (CO), nitrogen oxides (NOx), sulphur dioxide (SO<sub>2</sub>), volatile organic compounds (VOCs), particulate matter (PM) and a major emitter of carbon dioxide (CO<sub>2</sub>) and other greenhouse gases. Besides the short-range movement of air pollutants, that are most harmful for the health of the urban population, a long-range movement of these pollutants has also significant effects. The long-range movement of air pollutants from the transport sector, such as emissions of sulphur and nitrogen oxides, has resulted in acid deposition. Transboundary air pollution causes widespread acidification of terrestrial and aquatic ecosystems, which has impacts on human health, crop productivity, forest growth, biodiversity and man-made materials. Economic costs of this short-, and long movement of pollutants pollution are difficult to estimate; calculations may widely vary since methodology may differ. Research carried out in 1996 shows that the health costs in France, Austria and Switzerland due to PM<sub>10</sub> emission by traffic amount up to US\$ 27 billion per year.

To meet the environmental standards that are internationally agreed (post-Kyoto), it turns out that technological solutions alone won't be enough. The authors of the transport air pollution study for Europe<sup>45</sup> make a plea that a reduction can only be achieved when mobility demand is equally decreased. Demand management, changes in travel behaviour, increased use of less polluting modes of transport are crucial. This implies that NMT is a good option since a significant part of trips made in the cities are short and could easily be replaced by NMT.

The aspect of **health improvement**, resulting from physical exercise, is actually most valid in high income countries, where a certain level of facilities exists. Cycling can be a healthy, relaxing exercise that reduces the chances of getting ill or stressed. Reduced absenteeism and healthier, more relaxed employees increase the productivity of a company. Calculations show that this could save Dutch industries around 1.6 billion guilders a year on absenteeism and health insurance.

### 7.2.2 Poverty Reduction

It has been stated at various places elsewhere in this report that households in developing countries, the poorer ones in particular, rely heavily on NMT-modes. They do not have the minimum of mobility that is required to participate fully in social and economic terms in urban life. Especially walking is the key mode for those who can not afford a bus fare or the rent or purchase of a bicycle. Improvements in walking facilities will therefore have a direct impact on the poor since time spent on walking might be reduced due to de-tour prevention. Actually, for the poor time and money cost of access to employment, health services, education and other amenities are relatively high. The costs for trips to work can be a significant drain on income and inaccessibility may significantly reduce the prospects of employment in cities in developing countries. Lowering these costs contributes directly to poverty reduction.<sup>46</sup> It has been estimated that travel costs might reduce up to 25% in case walking speed is significantly improved; a 25 to 50% reduction of household travels costs can be expected when trip distances are reduced<sup>47</sup>, because of smaller de-tours. A more important impact of improved walking facilities is the reduced number of fatalities among walkers, the major component of traffic deaths in many countries. A sudden death or permanent injury of a member of a household may result in a disastrous situation at individual household level. A quantified assessment of the impact of NMT-measures on poverty reduction could not be found in literature.

Increased bicycle use will definitely reduce the household travel costs, and enlarge the average radius of action considerably. According to De Langen and Tembele urban cycling might reduce travel costs for a household up to 50%. Other reports found

comparable figures. As shown in chapter 2 the lower costs of cycling is often stated as the most important reason for cyclists to prefer the bicycle above the bus. Again, no reliable data could be found to calculate the impact of poverty.

Besides, increased bicycle use generates other spin-off effects at household level: employment in the bicycle service (repair, guarding) and production industry will increase. Jobs in these sectors are potential options for low educated people and more labour intensive compared to vehicle production. Further, as is also mentioned above, household's access to (non-bicycle) labour market can be enlarged. The case of orange sellers in a village in Ghana, described in World Bank's report on Poverty and Transport<sup>48</sup>, shows that women's income could rise significantly when they could bring their produce to the market in Accra instead of selling it in their village. The bicycle would have been the optimal solution for this; as compared to walking a bicycle enlarges the capacity for carrying freight considerably, and requires less physical efforts.

In construction of roads it turns out that the construction of pedestrian access infrastructure is one with a very high internal market multiplier effect since it can use low-skilled human resources and local building materials, much more than large-scale road infrastructure<sup>49</sup>.

### 7.3 Five strategies: Participation, Urban Planning, Education & Sensitisation, Incentives and Promotion, Capacity Building

#### 7.3.1 Participation

In chapter 6 the relevance of user/stakeholder participation has been mentioned as the key to success in all discussions and reports consulted. A lack of participation by users and other stakeholders will definitely lead to a weak and unsustainable result of interventions undertaken. Planned and implemented activities will not be understood and may even harm the interests of bicyclists and pedestrians. In cases of lack of participation during the design and planning, foot paths and bicycle lanes and paths quite often lead from nowhere to nowhere, are hardly used by cyclists or are used by others (motorbikes and cars, people who dry or stall their products).

The box on the right presents a part of the Statement of Delft (June 2000) in which it calls for including pedestrians and cyclists as stakeholders in any decision-making process.

#### Stakeholder participation

As is the case in other sectors, stakeholder participation is crucial in the preparation and implementation of sound and equitable policies, strategies, programmes, plans, and projects. National and local governments are urged to credibly involve, as a major group of stakeholders, pedestrians and cyclists in any decision-making process which directly or indirectly relates to their mobility and traffic safety requirements. In doing this, they should pay particular attention to the mobility needs of women, which are particularly affected by inappropriate urban transport solutions.

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The major and most-sustainable motivation people to join efforts in improving urban mobility freely is self-interest. Saving travel time, increasing safety, reducing costs and improving accessibility are often heard reasons to support actions. If interventions will certainly harm their interest, little co-operation might be expected. To overcome the resistance one might try to convince the partner with sound arguments, or compromise so that the major disadvantages are shared or removed. One can also decide to compensate the disadvantaged partner. Looking for "win-win" situations, where nobody loses, is usually the key to success. Chapter 6 has gone into more detail about the advantages and the conditions to have successful participation.

#### How can we promote participation?

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Participation is not an easy concept to implement. The political establishment shows quite often some reluctance to share responsibilities in policy making and implementation; planners and designers often assume they are the real experts and know what is best. They often feel themselves offended in their professional pride if participation is not organised in a proper way. To overcome the lack of support to participatory processes various approaches at various levels can be undertaken.

At the policy making level, participation belongs to a much wider administrative reform process. A mixture of sound donor pressure, intensive negotiations, showing good examples of successful decentralised and participatory planning and decision-making and cases in which significant cost-reductions has been made will help to make participation accepted as a way of modern and good governance.

The establishment of pressure groups within the local environment is another, very useful strategy. The Dutch case has shown us that the Dutch Cyclists' Union has played an important role in getting cycling on the political agenda.

At the planning and design level, participation meets similar resistance. There are a number of ways to tackle this problem: firstly, training and awareness raising among staff can help them to overcome their bias; secondly, showing good cases of successful participatory planning and design makes experts aware of the benefits of participation; thirdly, the formation of user groups, which on their turn may put pressure on the experts to include their ideas has turned out to be successful in many places; fourthly, political commitment and pressure on experts will ensure that "in words" the beneficiaries are heard and involved.

Fifthly, it is important to create a clear understanding of roles and competencies of the various parties involved, and that each participant is recognised in his expertise.

Chapter 6 has given a framework dealing with the questions: who should participate, at what stage and in what. A distinction has been made between general user groups, general user platforms and local user platforms. These groups/platforms might become involved in giving public information about all NMT-activities, consultation with users to identify and discuss user problems, organising participatory analyses and ranking priority, mobilising users for influencing decisions, changing behaviour and promoting user initiatives for implementing own proposals. They might be the one implementing, monitoring and or managing public infrastructure as well. Some authors do question this mixing of responsibilities and recommend a clear cut division, whereby the government is responsible for the broader weighing of interests. Nevertheless, it is useful to explore up to what level users and representatives can be involved in above-mentioned functions.

Besides the participation of the target group, it is important to activate other actors or stakeholders in a process of promoting cycling by contributing to planned and implemented measures. E.g. health care professionals can inform patients about the benefits of cycling exercise; employers can reward employees who come to their work by bicycle or offer financial support when purchasing a bike; shop keepers may have a direct interest in bicycle parking facilities in shopping areas; public transport authorities can offer parking facilities at places where passengers switch from bicycle to bus or train and v.v. This will stimulate the combined use of the bicycle and public transport. A process of sharing information, knowledge, interests and opportunities among the various stakeholders, (local government, user representatives and those like mentioned above) will lead to a synergy of action and therefore be more effective. A platform can be an useful forum for exchange and co-operation. In Appendix 6, an approach for a platform will be presented.

### **7.3.2 Urban Planning**

Traditional urban planning still relies heavily on Master Planning approaches as the panacea for solving urban scale problems. Transport issues are treated as simple traffic engineering tasks. Public participation has also been relegated to a less prominent role,

especially in the public sector, where planning processes have been set up with very little connection to reality or involvement of final target group. In interviews and literature the relevance of urban planning for the promotion for NMT has been highly emphasised. Especially the neglect by urban planners of the effects on transport modes has deteriorated the position of NMT in many cities. The strict spatial division within the city has extended trip distances significantly. Further concentration and urban sprawl has even worsened the situation.

#### How to overcome the problem of increasing trip distances?

1. Raising awareness among urban planners about planning consequences for transport and thus environment and economic/poverty.
2. Introducing the concept of multi-centred-cities.
3. Promoting the mixed composition of cities, so that residential and working places are close to each other.

### 7.3.3 Information campaigns and other promotion activities

In chapter 6 attention has been paid to promoting safety in traffic by information campaigns and effective communication. Here we will go into some more detail and introduce the concept of social marketing.

A strategy to inform citizens about policy measures and to convince them to change behaviour according to the measures, can not easily become effective without taking into consideration the determinants of behaviour, products and incentives that may facilitate the desired behaviour and the social environment of the citizens.

Information will only be effective if the message (product) presented is attractive and will result in personal benefit. For example, a newly constructed bicycle lane must offer people the opportunity to make use of it, i.e. it should match with the origin and destination of their trips, be easy accessible by bicycle and be competitive to alternatives. To make sure that increased cycling matches with the needs of citizens, social marketing approach can be applied. No extensive research exercises are required, though some might be useful; the approach is more a way of comprehensive thinking and taking into account factors of influence in order to formulate the best way to promote cycling. In Annex 5, a step by step approach of social marketing will be presented.

An effective messenger is one close to the final target group. This means that a government has to focus its training and awareness raising on intermediaries. The additional advantage is that through using intermediaries a much bigger population can be reached (multiplier effect).

### 7.3.4 Incentives and Promotion

The study has shown that there are a number of serious deterrents to the further growth of NMT. Safety and security (theft and harassment) are two factors often mentioned. Besides, the affordability of a bicycle and the procedure to get a license might scare off people. Moreover, the low status of walking and cycling is not promoting NMT. The poor facilities for NMT users (lack of proper NMT-friendly roads and connections, parking

#### Awareness raising

A major stumbling block in realising efficient and affordable mobility in African cities is the lack of awareness amongst politicians, administrators and professionals at national and local levels of the benefits of low-cost mobility options. In order to restore a balance in, and increase the efficiency of the urban transport systems, national awareness raising strategies will need to be developed and implemented. These should aim at raising their awareness of the economic and social importance of mobility, of the major role of walking and (the potential for) cycling, of the current inefficiencies of the urban transport systems as regards these modes, and of the ways and means to enhance low-cost mobility.

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places, showers at work) partly explain why NMT has such a low status. In chapter 6 we have elaborated on these deterrents and refrain therefore to go in much detail here.

The obvious and relatively easy measure to promote bicycles use is to lower the price of bicycles, either by reducing the consumer tax (VAT) or import tax. The latter, as this study has shown, can increase the number of bicycles bought significantly. Providing better facilities (and so improving its status) will help to overcome the deterrents. Better infrastructure, more parking opportunities, showers and dressing rooms at work will all have a positive impact on NMT use. Financial compensation and credit or bonuses for people using their bicycle to come to their work will increase NMT-use as well.

### 7.3.5 Capacity Building

The institutional environment has been identified as a key determinant in the use of bicycles (chapter 2). In a number of reports lack of capacity is mentioned as a crucial factor, hindering further development of NMT in urban areas. Though very little literature deals with capacity building for NMT extensively, from the Dutch case and interviews with experts, we might conclude that one should focus on the following issues:

#### 7.3.5.1 Policy development

Policies to promote NMT as such make little sense. It is the process that resulted in a certain policy that is more important. The writing of a Masterplan Bicycle, like in the Dutch case, is not something that went over one night. Before, authorities, planners and citizens agreed more or less that bicycling is an important way of moving through the city. The stakeholders differed in how to improve the situation for cyclists and to what extent other road users should be demotivated. The drafting of the project plan was a process in which the various stakeholders were included. In this way they became partners to a certain extent.

#### How can we promote NMT policy development?

There is no simple and single answer to this question. It will depend on many factors: the political system that is prevailing, the actual position and function NMT, the state of development of the country, the existence of a developed civil society etc. Fact is that all interviewees and most literature underscore the importance of a NMT supportive institutional and legislative environment. And, these are typically the result of a good NMT policy.

#### Demonstration projects

The consistent application of the 'menu of interventions' as an output of the SSATP pilot project at a large scale, and the monitoring and dissemination of the results thereof, will greatly help in raising awareness of the importance of efficient and safe walking and cycling, and in convincing politicians, administrators and professionals at the national and local levels, as well as the public at large, that this efficiency and safety can be greatly increased at relatively limited costs. For this reason, national and local governments are urged to plan and implement, at city or district level, a number of such demonstration projects in a number of countries, and to disseminate the results within Sub-Saharan Africa.

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As in many other countries, the role of the State Government is limited at local level. A nice Masterplan, developed at national level remains meaningless unless at local level NMT-friendly traffic management policy and plans are developed. The State Government should develop a vision, with some long-term objectives formulated. She can provide a framework within which various actors may develop their own short-term NMT-friendly policy. The State Government can provide financial support to assist lower levels, to carry out research, to disseminate knowledge, expertise and arguments, to develop local policy and plans and to experiment in pilot areas.

Therefore, instead of defining a detailed national policy, concentration should be on capacity building at lower, intermediary levels, such as provinces and cities, interest groups, regional or city directorates of transport, infrastructure and spatial planning.

Both the African and Dutch case study have shown us that experimenting and piloting on a small scale is a good start to attract public and political attention and to test out various practical measures for NMT promotion. Criteria for success should be considered carefully, in order to avoid the negative impact of a failure. These pilots can be used as inputs for further policy development, as do research and intensive monitoring and evaluation. The Delft Statement on Low Cost Mobility calls for these kind of demonstration and research pilots (see box).

Proper communication with other agencies and departments about activities and their results, as well as dissemination of results of studies and research (in form of reports, workshops, newsletters etc) may turn out to be essential for creating the right environment for developing an integrated and integral policy.

#### **7.3.5.2 Funds**

Financial means of governments in less-developed countries are limited. But even in case that funds would have been available, one might wonder whether these would be allocated to NMT-investments. As long as NMT is not an integrated part of transport planning and recognised as essential to proper transport management, one should earmark funds for NMT. In chapter 3 we have identified various sources for NMT investments.

#### **What should be done to expand the investments in NMT?**

1. Raise funds from international donors to invest in NMT-investments and promotion;
2. Reallocate national and local budgets more towards NMT;
3. Assess various existing and potential financial mechanism to tax or subsidise NMT and MT;
4. Link taxes and fees (on import, ownership, licenses for bicycles) to NMT investments;
5. Introduce a proper comparative cost-benefit methodology for investments in NMT and MT plans.

#### **7.3.5.3 NMT expertise**

The current **NMT expertise** in almost all countries of the world is limited. Transport decision-makers, planners and designers are schooled nearly exclusively in planning and designing for motorised traffic. The relevance and benefits of NMT have never been a subject during their academic schooling; designing and planning for NMT has been, if so, been dealt with in the periphery. The Delft Statement urges national governments to redress this situation (see box).

**How can we build up local expertise?**

1. Inclusion of NMT as one of the major topics in transport planning and design universities. It needs review and adjustments of the existing university curriculum.
2. In-service training for transport planners, designers and decision makers. This training might be provided by existing local universities at international centres of expertise (IHE Delft and I-ce are providing training courses for an international public regularly)
3. Participation of relevant staff in national and international conferences, networks and studies on NMT. Regular exchange and/or close co-operation with partner-countries or –cities.
4. Study tours/exposure visits to promising NMT-countries or cities.
5. Provision of communication facilities and opportunities to access up-to-date know-how.

**Human resources capacity building**

It is recognised that professional leadership capacities (urban planning and management, transport planning and management) are well below what is required, both in quality and in numbers, to prepare and implement sound and equitable low-cost mobility policies for the fast growing African towns and cities. National governments are urged to redress this situation, by providing relevant education and training opportunities, as well as attractive employment conditions, for professionals involved in urban mobility at the national and local levels. In addition, current relevant university level curricula should be upgraded to reflect current thinking about (low-cost) urban mobility, in order to better prepare graduates for their tasks.

*The Delft Low Cost Mobility Statement – June 2000.*

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**7.3.5.4 Mobilising and supporting local interest groups**

Local interest and advocacy groups can play an important role in the promotion of NMT. Strengthening their position can influence the quality of transport policy, the plans and designs and implementation. In places where pilot projects have been successful, the role of these user and advocacy groups was recognised at forehand.

**How can we support local groups?**

- 1) Funding of activities of existing and future groups (user as well as advocacy groups).
- 2) Establishment and training of groups in fund raising, awareness raising, campaigning, project management, negotiating etc.
- 3) Involving and assisting groups in steps of planning and design.
- 4) Support the establishment of international, national and local coalitions between user and/or advocacy groups.
- 5) Technical support to groups, international, national as well as local.
- 6) Provision of communication facilities.

**7.3.5.5 Benchmarking and guidelines**

Guidelines will help to strengthen the capacity of planners, designers and policy-makers to make the right decisions. Therefore the use and development of NMT-friendly guidelines should be promoted. Since local situations might be very different, guidelines should enable the user to apply and adjust them in a flexible way. The World Bank has paid considerable attention to the development of guidelines in the SSTAP project. One of the important sources of this report is the output of that project: Guidelines for

**Guidelines and quality standards**

National and local governments are urged to include these modes into mainstream urban transport policies, strategies, programmes, plans and infrastructure investment projects. In addition, the requirements for efficient and safe walking and cycling should be included in national urban roads design standards. The draft document 'Productive and Liveable African Cities: Guideline for Pedestrian and Bicycle Traffic' includes relevant proposals for such standards.

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Pedestrian and Bicycle Traffic in African Cities. The guidelines developed by a Dutch group of experts from various backgrounds and used by many Dutch designers and planners are now used world-wide<sup>50</sup>. The concept of benchmarking is quite new: in the Netherlands the Dutch Cyclists' Union (Fietzersbond) has been assigned by the Ministry to implement a benchmarking programme in order to develop and ensure high quality infrastructure and facilities. On European scale a policy benchmarking project is under implementation. In all participating countries the bicycle policy is under review, based on self-selected criteria. Such a self-evaluation is not only valuable for strengthening or improving one's own performance, but can also be a useful tool in communicating with other cities or partner organisations.

#### 7.4 Non-motorised transport system approach: integral and integrated

The authors recommend an integral and integrated approach concerning urban transport policy and planning. Transport in general, but non-motorised transport not differently, plays a number of functions, of which the major one is: playing a role in fulfilling the demand for mobility, i.e. the demand for transporting people and goods. Besides, it has a function in the employment of people, in the production as well as in the service industry; a role in improving the quality of life and in optimising the spatial distribution patterns.

The integrated approach recommended aimed at the need for an effective and coherent planning and implementation process based on a mutual understanding of legitimate interests and rights on the side of the civil society, as well as on the side of the civil-political authority. Doing so, it becomes clear that a whole range of stakeholders will enter the stage. Chapter 2 and 3 elaborated this issue in quite some detail. As has been shown, to pursue a successful integrated approach one should have the support of the political, professional and popular (or user) stakeholders.

Moreover, NMT should be dealt with in an integral way. In order to achieve success one has to consider several sectors. It may include the Banking sector (to provide loans for the purchase of bicycles), the Police (to enforce traffic regulations), the bicycle industry (to develop and practical bicycles, fit to be used in the circumstances), Public transport operators (to provide parking facilities at stations), Urban planners (to concentrate and/or mix functions of the city to limit travel distances), the media (to broadcast pro-bicycling reports) etc.

In both cases, the integrated and integral approach, three features come to the fore<sup>51</sup>:

- co-ordination, especially between stakeholders, planners, sectors and their activities, plans and funding;
- co-operation, especially between the stakeholders (such as mentioned above); and lastly
- co-mbination. The latter refers to at the same time designing and implementing.

Above all, these three co's form the factors for a successful integration of the bicycle in the urban society.

Rijnsburger<sup>52</sup> elaborated on this theme of integration and integral approach and identified 4 clusters of interest or policy fields that deal with NMT. These policy fields are transport, traffic, environment and economy. Table below gives an impression of what policy elements one might expect at various different starting points.

##### Mainstreaming low-cost mobility

Low-cost mobility has a direct relationship with, amongst others, poverty alleviation, economic and social development, employment generation, urban upgrading and development, and environmental protection. Rather than developing stand-alone low-cost mobility policies, national and local governments are urged to integrate low-cost mobility in policies, strategies, programmes, plans and projects that address these issues. As walking and cycling are an important part of the wider urban transport systems, they should be treated as such.

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Table 21 The four policy fields and their promising policy elements during three phases of NMT.

	<b>Transport</b>	<b>Traffic</b>	<b>Economy</b>	<b>Environment</b>
<b>Introduction phase</b>	Inclusion of NMT as a valuable mode of transport in the objectives, strategies and instruments of the policy.	Investment in shared road use and specific NMT infrastructure; inclusion of cycling in design and maintenance of roads.	Creating facilities for the purchase and benefits for the use of cycles; Alleviation of restrictions in imports and taxation.	Inclusion of cycling in subsidies and campaigns to promote alternatives for motorisation.
<b>Improvement phase</b>	Inclusion of NMT as an valuable mode of transport in the objectives, strategies and instruments of the policy.	Optimisation of the road infrastructure for NMT use and expansion of specific NMT infrastructure.	Balancing the effects of import regulations and taxation in comparison with other transport modes.	Profiling the environmental importance of cycling against motorization.
<b>Preservation phase</b>	Inclusion of NMT as an endangered mode of transport in the objectives, strategies and instruments of the policy.  Development of instruments to regulate motorization.	Reduction of intensities and speeds of motor traffic;  Rationalisation of motor traffic accessibility.	Introducing benefits for NMT against motorization.	Profiling the environmental importance of NMT against motorization.

In the table below, we elaborate on these four “policy fields”, and indicate what policy elements they may exist of in the three phases of NMT. It shows that in the policy field “transport”, “integrated transport planning” and “separate NMT-promotion” are the two appropriate policy instruments to support NMT. When looking at the policy field “traffic”, “integrated traffic management”, “NMT network planning” and a “road safety planning” are suitable. Cycling promotion with the aim of mitigation of air pollution and of urban degradation are policy approaches that can enhance or improve the environment. The impact of increased cycling on the economy comes through improved commuting and communication, industrial and small enterprise development and the reduction of fuel imports.

Transport	Traffic	Economy	Environment
<ul style="list-style-type: none"> <li>• <b>Integrated transport planning:</b> <b>Options:</b> Generation of targets, instruments and means to enhance cycling (pull) and discourage motorised modes (push).</li> <li>• <b>Focused NMT promotion:</b> <b>Options:</b> Generation of targets, instruments and means to enhance NMT.</li> <li><b>Threats:</b> Requirements for NMT secondary to predominant and favoured modes by overall transport planning.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Integrated traffic management:</b> <b>Options:</b> Inclusion of NMT in accessibility planning and road design; Regulation of speeds and traffic flows (traffic calming).</li> <li><b>Threats:</b> NMT efficiency secondary to interests of dominant modes.</li> <li>• <b>NMT network planning:</b> <b>Options:</b> Creation of a coherent infrastructure of NMT facilities and shared road space (effectiveness and efficiency of NMT)</li> <li><b>Threats:</b> Network optimisation secondary to interests of dominant modes</li> <li>• <b>Road safety planning:</b> <b>Options:</b> Investment in infrastructure, legislation and campaigns to promote safe NMT.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Improved commuting:</b> <b>Options:</b> Investment in NMT infrastructure and facilities, direct and in combination with public transport.</li> <li>• <b>Improved communication:</b> <b>Options:</b> Operation of a parcel service and errand services by bicycle.</li> <li>• <b>Industrial development:</b> <b>Options:</b> Manufacturing and trading of bicycles, parts and accessories</li> <li>• <b>Small-scale enterprise development:</b> <b>Options:</b> Use of cycles by petty trading and small enterprise. Creation of cycle parking and repair facilities.</li> <li>• <b>Reduction of fuel imports:</b> <b>Options:</b> Substitution of MT.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Mitigation of air pollution:</b> <b>Options:</b> Investment in substitution of motorised transport by NMT as non-polluting modes.</li> <li><b>Threats:</b> Substitution of motorised transport by NMT secondary to the introduction of sub-surface (rail) infrastructure.</li> <li>• <b>Mitigation of urban degradation</b> <b>Options:</b> Investment in substitution of motorised transport by NMT as non-polluting modes.</li> <li><b>Threats:</b> Substitution of motorised transport by NMT secondary to the introduction of catalytic converters in motors engines.</li> </ul>

## CHAPTER 8 CONCLUSIONS AND RECOMMENDATIONS

### 8.1 Conclusions

#### **The trend: a decrease in NMT-use**

Though NMT contributes positively to a number of valuable issues, the tendency is that NMT will decrease in number of trips and kilometres per person if no promotional policy (including investments in NMT) is carried out.

It appears that in a growing number of countries economic development goes hand in hand with motorization of transport, initially public, later private motorised transport. The dominant position of motorised traffic is one of the major deterrents for NMT.

The factors influencing the choice for NMT or MT can be grouped as follows:

- infrastructure/physical factors
- individual/societal factors
- institutional factors

This paper shows that a supportive institutional environment is essential for the development of NMT and should receive (as in the case of The Netherlands) much more attention.

An active NMT policy should be pursued since assessments of people at individual level will not automatically lead to a choice for NMT, or a choice that is optimal for society as a whole.

#### **Who is using NMT?**

The use of NMT is rather biased in developing countries. The proto-type cyclist is a man, aged 25-35 who is employed and has an income high enough to afford a bicycle. In walking such a gender bias can not be observed. Since women would benefit significantly when NMT (read: bicycles) lies within their reach, promotional campaigns must be targeted on them. The gender bias in cycling should not be taken for granted.

#### **The motives for (not) using NMT**

People's motives to use or to refrain from using NMT differs from one country to another. A significant difference between people in developed and developing countries can be observed. In developing countries, captive-ridership (i.e. no other options to choose from than NMT), is often heard as the main reason for walking or cycling.

A number of disincentives for NMT are lack of road safety, lack of infrastructure and lack of social safety (esp. for women). Studies have shown that besides a gender bias, a policy (and attitudinal) bias also exists. This bias includes high taxes for bicycle imports, bicycle registration procedures and special fees. Motorised transport is quite often promoted by means of not charging motorised road users for their external effects, or subsidising fuel. When promoting NMT one should consider and overcome these problems.

But, a number of people in developing countries values NMT for its affordability, flexibility, time-efficiency and speed, and prefers it above motorised transport. These positive attributes are even recognised by non-NMT-users as this report has shown.

### **Benefits from NMT**

The benefits that would accrue to society will outnumber the costs of the investments. Benefits in the field of quality of life and economic development in urban areas can be expected. Improved attractiveness and accessibility of the city, increased employment and public savings, health and environmental improvements are among the major impacts. Therefore NMT promotion is regarded as an important tool for poverty reduction.

### **Need for an integral and integrated approach**

To ensure that interventions will have the desired impact, it is required to follow an integrated and integral or holistic approach. NMT has the most impact when it is integrated in plans and policies related with poverty alleviation, economic and social development, employment generation, urban and regional planning, urban upgrading and environmental protection. Urban planning should pursue mixed-cities where work and residential areas are close by and trip distances accordingly short.

The physical possibility to walk and cycle on roads is very much related to the density and speed of motorised traffic. In particular busses and lorries are prohibitive to the lateral use of curbs as well as crossing over by pedestrians and cyclists. Because of this NMT needs to be integral part of urban transport planning and management.

### **How to start?**

In a city where cycling hardly exists generic interventions are recommendable. In cities where NMT takes a considerable share in number of trips, specific interventions that benefit NMT mainly are proposed. Traffic calming is a good starting point that will improve overall traffic situation.

In situations where generic and specific interventions are complementary, a synergy arises. It shows that one should not always start with big (long-term) investments for specific modes. Further, one or two major weak points in a specific facility for a bicycle can undermine the high quality of a route. It is therefore a waste of efforts and money to invest in a few expensive, high quality bicycle routes in a city where cycling is not popular or safe, especially on access or collector roads.

### **Need for partnerships**

The Dutch case shows us that in a tri-angular context of professionals, users (consumers) and politicians, partnerships should be established to ensure sustainable and successful plans. Lack of consensus or failing partnerships between these groups can result in a lack of political willingness, meagre resource allocation and undesirable and ineffective plans.

### **Upscaling local initiatives**

Changes in city traffic and transport in which cycling is (positively) involved, are often initiated and carried by individuals, such as activists, professionals and civil servants or politicians. Upscaling to higher levels is then the necessary approach for integration of cycling in urban and national policies, resource allocation for infrastructure, and for changing the perceptions of citizens with respect to status and economic benefits.

## **5 Strategies for developing NMT**

Strategies for NMT development may include: participation – urban planning – education & sensitization – incentives and promotion and capacity building.

A programme of capacity building for policy development, allocating funds, improving technical know-how and expertise, mobilising and supporting local interest groups will

contribute to NMT development. Benchmarking and guidelines are necessary tools to ensure quality of investments.

### **Stakeholder participation**

- User/stakeholder participation has been mentioned as a key factor to success in all discussions and reports consulted. A lack of participation by users and other stakeholders will definitely lead to a weak and unsustainable result of interventions undertaken. Planned and implemented activities will not be understood and may even harm the interests of bicyclists. In cases of lack of participation during the design and planning, bicycle lanes and paths quite often lead from nowhere to nowhere, are hardly used by cyclists or are used by others (motorbikes and cars, pedestrians, street vendors). At the policy making level, participation belongs to a much wider administrative reform process.

### **Urban planning and sensitization**

The neglect by urban planners of the effects of their planning on transport modes has deteriorated the position of NMT in many cities. The strict spatial division of work and living within the city has extended trip distances significantly. Further functional concentration and urban sprawl has even worsened the situation.

Raising awareness among urban planners about planning consequences for transport and thus environment and economic/poverty can overcome this problem, along with the introduction of the concept of multi-centred-cities, where residential and working places are close to each other.

### **Removing professional biases**

Planning and design professionals often have their own biases and so hinder the development (or even existence) of NMT. Ways to overcome these biases are:

- Training and awareness raising among staff;
- Showing cases of successful participatory planning and design; experts may become more aware of the benefits of participation;
- Formation of user groups, which on their turn may put pressure on the experts to include their ideas has turned out to be successful in many places;
- Political commitment and pressure on experts will ensure that "in words" the beneficiaries are heard and involved.

Creating a clear understanding of roles and competencies of the various parties involved, and that each participant is recognised in his expertise.

### **Communication and awareness-raising**

A strategy to inform citizens about policy measures and to convince them to change behavior according to the measures, can not easily become effective without taking into consideration the determinants of behavior (e.g. products and incentives that may facilitate the desired behavior and the social environment of the citizens). Information will only be effective if the message (product) that is presented is attractive and result in personal benefit. One can think of using a social marketing approach.

### **Incentives and removal of disincentives**

Reducing consumer tax (VAT) or import tax on bicycles and providing better facilities (and so improving its status) will remove major NMT disincentives. Better infrastructure, more parking opportunities, showers and dressing rooms at work will all have a positive impact on NMT use. Financial compensation and credit or bonuses for people who walk or cycle to their work will increase NMT-use as well.

### **The replicability of the Dutch National Master Plan**

The author argues that a national masterplan, like the one from the Netherlands, can be relevant and suitable for developing countries as well, since the Dutch Masterplan is not very prescriptive. It enables the stakeholders to become involved in actual local policy and plan-making and motivates them to take their own responsibility. It defines some future goals and directions. Such an approach, without prescribing which specific measure should be carried out, is realistic and useful.

The issues in the Dutch National Bicycle Plan as communication with stakeholders (and offering forums for exchanging ideas and experiences) and capacity building are relevant for all countries. The strengthening of user platforms and NMT-advocacy groups has already been adopted in various countries. Decentralisation is a phenomenon not only relevant for the Netherlands, but also for other countries. A strategy targeted on defending the existing NMT-use should come before exploring new markets for NMT.

These conclusions are based on the experiences in a limited number of countries. Further field research on the use of NMT, including non-motorised freight transport and accurate evaluations of NMT projects can provide insight in factors that are contributing to successful and sustaining NMT-strategies.

### 8.2.1 Recommendations

The Bank has a rich history with respect to the implementation of physical transport infrastructure projects, which in many cases have created a good basis for development. Since early nineties, the Bank is aware of the fact that NMT has been neglected in her projects for improving mobility. She has implemented and supported a range of projects in Africa (SSATP), Lima (Peru) and Bogota (Colombia) since. The Bank can continue to play an important role in getting NMT on the political agenda and to ensure the proper valuation and inclusion of NMT in transport programmes worldwide. As a lender and as an important knowledge centre the Bank has instruments to do that.

It is recommended that the Bank will:

#### **focus on integral and integrated transport planning**

The Bank should assist countries:

- in integrating NMT policies, strategies, plans and projects in plans related with poverty alleviation, economic and social development, employment generation, urban upgrading and environmental protection.
- in mainstreaming NMT policies, strategies, plans and projects in overall traffic and transport management policy.
- in ensuring that NMT interests are considered and protected (and that NMT quality loss is compensated) in case of road infrastructure programmes.
- in redirecting and guiding urbanisation in such a way that functions of a city are mixed (working, shopping, recreating and residing) in order to keep trip distances relatively short and thus creating opportunities for NMT.
- in taking away the need for a shift to motorization and the therefrom resulting need of high public investments.

#### **focus on health and life threatening situations**

The Bank should assist countries:

- in improving safety for pedestrian and bicycle users and reduce the more-than-proportional share of traffic injuries and fatalities among these NMT-users.

#### **focus on removing biases against NMT**

The Bank should assist countries:

- in removing or adjusting procedures, formalities and legislation that are directly or indirectly undermining the use of NMT (bicycle road tax, bicycle registration fees and licenses, no recognised or described traffic rights etc).
- in removing high import taxes on bicycles (and treating them as a luxury item).
- in eliminating the bias towards motorised road users in terms of subsidies on petrol, road construction and for not charging the MT-user for congestion, pollution and safety problems;
- in including the aforementioned externalities in road user charges.

- in ensuring that decisions concerning to transport investments are made based on proper cost-benefits analyses of various MT and NMT options.
- in supporting initiatives to change perceptions and remove biases and to promote NMT as a means of transport for all (regardless sex or income).

### **stimulate participation of stakeholders in planning, design, and implementation**

The Bank should assist countries:

- in providing stakeholders opportunities to participate actively in decision-making concerning planning, design, and implementation of NMT interventions.
- in ensuring that traffic and transport problems of road users, NMT-users in particular, are considered in aforementioned stages; and that interventions are aimed to solve the mobility problems, especially of the poorer sections in society.
- in mobilising and supporting user platforms, associations, interest groups and advocacy groups of road users, NMT-users in particular.
- in promoting partnerships between government, private sector and public transport sector with regard to NMT.

### **focus on the urban poor and their transport problems**

The Bank should assist countries:

- in creating better NMT conditions for the poor so they can increase their mobility and reap the benefits of economic and social development and to get improved access to jobs, education, health and other services.
- in designing cost-effective labour-based construction programmes for NMT infrastructure.
- in channelling credit / revolving funds through banks or NGO's that have developed credit modalities and have the capacity for loaning small sums to (relatively) poor customers in a cost-effective and profitable way.
- in ensuring that gender biases in the provision and use of NMT will be eliminated through targeted promotional campaigns, (saving- and) credit programmes, legislation etc.

### **focus on capacity building for NMT development**

The Bank should assist countries:

- in policy making at various levels, thereby promoting decentralised policy making; it can stimulate the development of a Master Plan at national level, so that an enabling environment for further NMT development at lower levels is created.
- in working out traffic and transport strategies and plans for NMT (and ensure its integration in an overall transport strategy or plan) at lower levels.
- in developing mechanisms for internal funding and attracting external funding (including loans from international financial institutions like the Bank itself)
- in building up expertise in NMT, through supporting universities and training centres to update their curricula; in-service training for transport planners, designers and decision makers; organising conferences, study tours, exchanges with "sister"-cities; and providing communication facilities to get access to international networks/literature etc.
- in building up knowledge through research, experiments and pilots and ensuring quality of transport facilities through pursuing benchmarking and producing and disseminating guidelines for NMT-facilities design, NMT-integration in urban transport policy and planning, and NMT promotion.
- in developing legislation in which attention is paid to the rights and responsibilities of NMT-users.

Furthermore, we recommend the Bank to:

- provide only loans for transport programmes in which the role of NMT is clearly described and recognised and suggestions/plans are included to support this role.
- support training and education programmes focused on strategic planning of NMT projects.



- support further quantitative research on the role of NMT in freight transport, public transport, poverty alleviation and employment. In addition to this, research on its role in the reduction of emissions that harm the health and environmental situation should be supported.
- support the establishment of an international network for NMT development, in order to take full advantage of international exchange of experience and expertise. This may be a NGO closely related to the Bank.
- support the development of national Chapters for NMT development, as constituent partners for the above mentioned network.

### 8.2.2 Additional recommendations

This report shows an overview of the position of NMT in total mobility. Much attention has been paid to best practices in planning, in choice of interventions, in supporting NMT development etc. It has provided a whole range of options and approaches for future action. A complete list of all these recommendations and suggestions won't help the reader. Hereunder only general recommendations are mentioned as long as they have not been mentioned as recommendations to the Bank.

In order to have sustainable success, it is recommended:

#### Planning:

- 1) to develop an urban mobility plan for bicycle and pedestrian transport as an integral part of a city's transport and traffic policies and plan.
- 2) to develop an action plan with immediate or short-term, tangible results prior or parallel to the urban mobility plan.
- 3) to distinguish between non-cycling cities/areas and places where cycling has already an important share in traffic.
- 4) to look for a good balance between ambition and realistic and feasible objectives.
- 5) to make a functional hierarchy of roads (access, distribution, transit) so that for each category specific measures can be taken.
- 6) to plan NMT interventions following an area-wide approach. The size/scale of such an area should match with the characteristics of NMT-trips. This could either be a small or medium sized city or a district of big cities. In the latter case the interventions can gradually be extended to other districts.

#### Interventions:

- 1) to implement area-wide speed reduction measures apart from roads with a flow function for motorised traffic.
- 2) to develop and implement design standards for infrastructure for pedestrian, bicycle and all motorised transport.

#### Legislation and regulation:

- 1) to introduce priority rules (right of way) and regulations for cyclists and pedestrians in urban areas and technical measures that support priority and stimulates perception and anticipation.
- 2) to introduce a graduated or intermediate licensing system for young car drivers and motorised two wheelers.
- 3) to set the BAC limit for MT users at a lower level: 0.01% (alcohol limits).
- 4) to change rules of liability (a higher order of transport is always liable unless it can prove a case of force majeure).

#### Education and awareness campaigns:

- 1) to combine education and awareness activities with other interventions since they seem to have little impact when carried out in isolation.
- 2) to refrain from negative campaigning concerning MT.
- 3) to make use of intermediaries to convey the message to final target groups.

- 4) to adjust the message and the method of education and campaigning to the target group (social marketing concept).

## Endnotes

- <sup>1</sup> Urban Environmental Planning and Management Strategies for Sustainable Split Modal Transportation in Arequipa, Peru. Luis Mauricio Huaco Zuniga (1997)
- <sup>2</sup> Bicycle Master Plan for Delhi - a Summary of Final Report, TRIPP (2000)
- <sup>3</sup> The Dutch Bicycle Master Plan – Description and Evaluation in an Historical Context, Ministry of Transport, Public Works and Water Management, the Netherlands (1999)
- <sup>4</sup> Fietsverkeer in praktijk en Beleid in de Twintigste Eeuw, Ministry of Transport, Public Works and Water Management (1999)
- <sup>5</sup> Cycling Promotion and Bicycle Theft – Local background studies in Leon (Nicaragua), Lima (Peru), New Delhi (India), Guangzhou (China), and Accra (Ghana), I-ce (1997)
- <sup>6</sup> Non Motorised Transport in Urban Areas: On the verge of extinction or hope for the future? Tiwari, G. (1995)
- <sup>7</sup> Gomez Lara M. (2000) Gender analysis of two components of the World Bank Transport project in Lima, Peru: bikepaths and busways. Draft.
- <sup>8</sup> Cycling Promotion and Bicycle Theft – Local background studies in Leon (Nicaragua), Lima (Peru), New Delhi (India), Guangzhou (China), and Accra (Ghana), I-ce (1997)
- <sup>9</sup> Cycling Promotion and Bicycle Theft – Local background studies in Leon (Nicaragua), Lima (Peru), New Delhi (India), Guangzhou (China), and Accra (Ghana), Synthesis Report. Tiwari, G. and R. Saraf, for I-ce (1997).
- <sup>10</sup> Policies for urban non-motorised transport – in: SSATP Preliminary assessment report 1993.
- <sup>11</sup> Structure of I-ce' s Interactive Training Programme – Explanation of a Holistic Approach, Pettinga, A. (2000).
- Municipal Financing of Urban Road Infrastructure and Facilities for Pedestrians and Bicycles, Matovu, G. (2000) Paper presented in the Expert Group Meeting on Low-Cost Mobility in African Cities, the Netherlands (pp3-8).
- The Bicycle in Africa: luxury or necessity, Velo City Conference Nottingham, Howe, J. and R. Dennis (1993).
- <sup>13</sup> Opiyo, T. and J.Koster (2000); Human Resources Requirements in Local Authorities – Principles and Case Study of Kenya (discussion paper).
- <sup>14</sup> Delft evaluation (XXX)
- <sup>15</sup> Bicycle Master Plan for Delhi – Final Report. Transport Department Government of New Delhi, 1998.
- <sup>16</sup> Geetam Tiwari – Personal communication (June 2000)
- <sup>17</sup> Productive and Liveable Cities: guidelines for pedestrian and bicycle traffic in African cities, by de Langen.M and R. Tembele (ed) 2000
- <sup>18</sup> Dutch Designing Manual for Bicycle-friendly Infrastructure; Rotterdam/Ede, March 1993, as quoted in: Non-Motorized Friendly Infrastructure Planning and Traffic Management – An Overview of International Experience and Literature Relevant for Sub-Sahara Africa: Grontmij, (1993)
- <sup>19</sup> Guidelines for pedestrian and bicycle traffic in African cities”, WB SSATP (2000), section 5.1 and 6.3
- <sup>20</sup> D.Mohan (2000). Measures to Improve Road Safety of Vulnerable Road Users. Paper for the I-ce Velo Mondial Interactive Training Programme.
- <sup>21</sup> Kajzer, J. Yang, YK and D. Mohan (1992). Safer Bus Fronts for Pedestrian Impact Protection in Bus-Pedestrian Accidents. Proceedings 1992 International IRCOBI Conference on the Bio-mechanics of Impacts, IRCOBI, Bron, France, 13-23.
- <sup>22</sup> Guidelines for pedestrian and bicycle traffic in African cities”, WB SSATP
- <sup>23</sup> Sign up for the bike
- <sup>24</sup> Guidelines for pedestrian and bicycle traffic in African cities”, WB SSATP, section 14.2.
- <sup>25</sup> Guidelines for pedestrian and bicycle traffic in African cities”, WB SSATP, chapter 14, figure 14.1, 14.2 and 14.3.
- <sup>26</sup> The authors have deliberately used the information from “Guidelines for pedestrian and bicycle traffic in African cities”, WB SSATP, chapter 12 and 13.
- <sup>27</sup> This entire section is based on: The results of four cost—benefit calculations, I-ce (2000).
- <sup>28</sup> Litmann, T. (1996) as cited in: The results of four cost-benefit calculations, I-ce (2000).
- <sup>29</sup> Daggars, T. (2000): the economic benefits of cycling in Santa Fe de Bogota, Colombia.
- <sup>30</sup> Abbey, M.A. and M. de Langen (2000) Economic costs and benefits of cycling in Morogoro, Tanzania.

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- <sup>31</sup> Based on a study conducted by the Indian Institute of Technology.
- <sup>32</sup> Wittink, R. (2000): Safety and Vulnerability of cycling – the interdependence between mobility and safety (unpublished paper).
- <sup>33</sup> Wittink, R. (1998): Road Safety Education, in: An Introduction to Road Traffic Safety – a Multidisciplinary Approach.
- <sup>34</sup> Saad, F. (1999); Communication with Road Users, in: An Introduction to Road Traffic Safety – a Multidisciplinary Approach.
- <sup>35</sup> Lassarre, S. and N. Muhlrad (1998): The Safety Diagnosis, in: An Introduction to Road Traffic Safety – a Multidisciplinary Approach.
- <sup>36</sup> Tiwari, G. (1998): Recording Traffic Crashes, in: An Introduction to Road Traffic Safety – a Multidisciplinary Approach.
- <sup>37</sup> Cycling and Bicycle Theft, Local Background Studies in Guangzhou (China), Leon (Nicaragua), Lima (Peru), New Delhi (India) and Accra (Ghana), I-ce 1997.
- <sup>38</sup> Guitink P.(1996) during Velo Australia (Perth 1996)
- <sup>39</sup> Amrita Daniere, University of Toronto, Sustainable Urbanisation in Mega-cities: role of NMT. TRB 1998.
- <sup>40</sup> World Bank (1995); Sustainable Transport – A Sector Policy Review.
- <sup>41</sup> Cycling and Bicycle Theft, Local Background Studies in Guangzhou (China), I-ce 1997.
- <sup>42</sup> World Bank (1994): Non-motorised Transport: Confronting Poverty Through Affordable Mobility.
- <sup>43</sup> Guidelines for pedestrian and bicycle traffic in African cities”, WB SSATP, section 17.
- <sup>44</sup> The Economic Significance of Cycling, Buis, J. and R. Wittink (I-ce) 2000.
- <sup>45</sup> Haq, G. and P. Bailey (1998) Air Pollution from the Transport Sector - A Scenario Study for Europe. Swedish Environmental Protection Agency.
- <sup>46</sup> World Bank (1995). Sustainable transport – A Sector Policy Review.
- <sup>47</sup> Productive and Liveable Cities: guidelines for pedestrian and bicycle traffic in African cities, by de Langen.M and R. Tembele (ed) 2000, pp 13-16
- <sup>48</sup> Poverty and Transport – World Bank, 1998 (as referred to in The Economic Significance of Cycling).
- <sup>49</sup> Productive and Liveable Cities: guidelines for pedestrian and bicycle traffic in African cities, by de Langen.M and R. Tembele (ed) 2000.
- <sup>50</sup> Signing up for the Bike.
- <sup>51</sup> Personal communication with Pettinga, A. June 2000.
- <sup>52</sup> Policies for urban non-motorised transport – in: SSATP Preliminary assessment report 1993.

# World Bank Urban Transport Strategy Review

## Terms of Reference

Review of experience with respect to the planning and implementation of infrastructure for non-motorized transport in developing countries.

### Background

1. The World Bank is undertaking an Urban Transport Strategy Review. This will be the first comprehensive and detailed examination of this subject since the previous Urban Transport Strategy was published in 1986. A Draft Concept Note for the Review is attached as Annex 1. The Review is to be informed and supported by a series of position papers collating experience and best practice on different topics in urban transport. These papers will identify critical problems and issues, the outcome of interventions, organizational models, etc. The papers will be widely disseminated as the basis for improving understanding and collaboration in the field of urban transport in developing countries. The Strategy Document will reflect this digest of experience, though any policy statements will be the responsibility of the Bank and not attributed to authors of the review papers.

2. In support of this activity the Netherlands Trust Fund in the World Bank is funding a number of reviews of relevant Dutch experience in urban transport. It is intended to include both direct experience in developing countries and experience within The Netherlands. The general objective of the studies is to define if, and in which way, Dutch experience in urban transport planning and administration in large and medium size towns is adaptable to other countries, and under which conditions.

3. Non-motorized transport plays a dominant role as the cheap, but sometimes unpleasant and dangerous, main mode of transport in some of the very poorest countries, with the consequence that it is frequently associated with poverty as something that countries aim to develop out of. It is beginning to play an increasing role, albeit usually as a convenient and non-polluting local distribution mode in multi-modal systems, in a number of high income industrialized countries such the Netherlands. The World Bank is particularly concerned to ensure that the strategy which it pursues for urban transport development is sensitive to the need to properly utilize the potential of non-motorized transport.

### Objective

4. The objective of the study is to identify the factors determining the effectiveness of non-motorized transport in contributing to the health of the city economy, as well as the impact on the quality of life in developing countries. In addressing the very wide ranging questions the consultants should refer to experience both in the Netherlands and in developing countries, and pay particular attention to the question of the applicability of arrangements developed in the Netherlands in developing countries.

### Scope of Work

5. The successful mobilization of the potential of non-motorized transport in the Netherlands has been the result of very effort to facilitate it through the provision of separate infrastructure protecting NMT from dangerous conflict with other vehicles, and by the provision of attractive modal interchange facilities.

6. The review will consider experience with NMT, both as a public and private transport mode, giving particular attention to;

- a) identifying appropriate roles for NMT at different stages of development;
- b) identifying the factors which may limit the use of, and any systematic biases against, NMT in developing countries;
- c) identifying the necessary public sector actions to facilitate those roles;
- d) suggesting warrants for the separation of NMT infrastructure;
- e) identifying, insofar as it is considered appropriate, generic design standards for infrastructure for NMT, and for the intersections and interfaces between NMT and other modes;
- f) specifying the circumstances in which NMT should be encouraged as a mode of public transport in developing countries.

**Supervision**

7. The consultancy is procured by the World Bank under the normal conditions applying to the Netherlands Trust Fund. The World Bank will nominate an officer to supervise the work and to liaise with the consultant on its content and scope.

**Resources**

8. It is expected that the review will require up to 2 person months. The work will be conducted primarily in the Netherlands: this requires that the consultants have a first-hand knowledge of issues in developing countries and of the related solutions and debates related to them. The consultant team should be composed of one or two experts who have an easy access to all available relevant documentation, in public as well as private libraries and data bases.

**Schedule and Reporting**

9. A short inception report in *five* copies will be submitted within *three-four* weeks of instructions to proceed with the project. The inception report will outline an assessment of data availability and the cities proposed for evaluation.

10. The final report (100 pages at most, including appendixes) shall contain: -  
Recommendations on the issues set out in section 6 above

- Appendices,

- An annotated bibliography.

11. The draft final report will be submitted in *ten* copies within *twelve-sixteen* weeks of instructions to proceed with the project. The report will be delivered to the World Bank in a provisional version, in English after 4 months. The World Bank will deliver comments within 15 days. The final report in *twenty* copies will be submitted, in English, within *two* weeks of receiving comments on the draft final report from the World Bank.

12. Each report (inception, draft final, and final) will be submitted in an electronic format acceptable to the Bank (for example, Microsoft Word). All raw data files, intermediate calculations, and final calculations and spreadsheets, graphics, model runs (if any), and working papers files will also be submitted in electronic format.

## **APPENDIX 2: CONTRIBUTORS**

The following people have contributed to the production of this report; their names are in alphabetical order:

### **Sounding board members:**

Jeroen Buis  
Bicycle expert

Tom Godefrooij  
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### **Resource persons:**

Carlos Cordero  
Ton Dagers  
Luis Zuniga Huaco  
Geetam Tiwari

**ANNEX 3: STUDY PLANNING MATRIX**

		Means of verification	Assumptions
<b>Development/overall objective:</b>	A World Bank urban transport strategy including a NMT-component, based on a sound assessment of its potentials and limitations.	World Bank report	
<b>Immediate objective:</b>	Overview of factors determining the effectiveness of NMT in contributing to the health of the city economy, as well as the impact of life in developing countries.	Final report	
<b>Output:</b>	<ol style="list-style-type: none"> <li>1. Appropriate roles of NMT at different stages for development identified</li> <li>2. Opportunities for NMT in developing countries, including suggested key actors and necessary actions to be included in NMT strategies identified</li> <li>3. Factors which may limit the use of, and any systematic biases against NMT in developing countries identified</li> <li>4. Criteria for the separation and /or integration of motorised and non-motorised road-users suggested</li> <li>5. Potential gender and cultural biases for NMT use identified and approaches to overcome these identified</li> <li>6. Benefits of the low income population from improvements in NMT conditions highlighted</li> <li>7. Circumstances in which NMT should be encouraged as a mode of public transport in developing countries specified</li> <li>8. Options for financing NMT interventions suggested</li> <li>9. Information on costs and benefits of most important interventions provided</li> </ol>	Final report	Activities implemented as proposed.
<b>Activities:</b>	<ol style="list-style-type: none"> <li>1. Desk study of relevant literature</li> <li>2. Interviews with key informants</li> <li>3. Meeting with I-CE</li> <li>4. Discussion with/in sounding board</li> </ol>	<p>Inception report</p> <p>Minutes of meetings</p> <p>Workshop report</p> <p>Draft report</p>	



**APPENDIX 4:       SELECTED BIBLIOGRAPHY**

CROW (1992). Still More Bikes Behind the Dikes. Reader on Policy and Research for Bicycle Facilities in the Netherlands.

CROW (199 ). Signing Up for the Bike.

Directoraat Generaal Rijkswaterstaat (1999). Fietsverkeer in Praktijk en Beleid in de Twintigste Eeuw. The Netherlands.

I-CE (2000). The Economic Significance of Cycling. A Study on the Costs and Benefits of Cycling Policy.

I-CE (2000). The Results of Four Cost-Benefit Calculations: Amsterdam, Bogota, Delhi, Morogoro.

I-CE (1997). Cycling Promotion and Bicycle Theft – Local Background Studies: Synthesis.

I-CE (1996). Cycling Promotion and Bicycle Theft – Local Background Studies: Leon, Nicaragua.

I-CE (1996). Cycling Promotion and Bicycle Theft – Local Background Studies: Lima, Peru.

I-CE (1996). Cycling Promotion and Bicycle Theft – Local Background Studies: Delhi, India.

I-CE (1996). Cycling Promotion and Bicycle Theft – Local Background Studies: Gangzhou, China.

I-CE (1997). Cycling Promotion and Bicycle Theft – Local Background Studies: Accra, Ghana.

IHE (2000). Low Cost Mobility in African Cities (Reader for the Expert Group Meeting in Delft, the Netherlands)

ISTED (1999). Building Blocks of Urban Transport Development Strategy in the Developing Countries.

Ministry of Transport and Public Works, Transportation. Evaluation of the Delft Bicycle Network (Final Summary Report), The Hague, the Netherlands.

Pettinga, A. (1993). Non-Motorized Friendly Infrastructure Planning and Traffic Management. (Final Consultant Report) An Overview of International Experience and Literature Relevant for Sub-Sahara Africa.

SSATP (2000). Productive and Liveable Cities. Guidelines for Pedestrian and Bicycle Traffic in African Cities.

TRIPP (1998). Introduction to Road Traffic Safety: a Multi-disciplinary Approach. Delhi, India.

TRIPP (1998). Bicycle Master Plan for Delhi. (Summary)

World Bank (1993). Environmental Priorities in Transport Policy (Draft). Washington, DC.

World Bank (1995). Sustainable Transport: A Sector Policy Review (Draft). Transportation, Water and Urban Development Department. Washington, DC.

Zuniga, L.M.H. (1997). Urban Environmental Planning and Management Strategies for Sustainable Split Modal Transportation in Arequipa, Peru.

## APPENDIX 5:

### STEP BY STEP APPROACH OF SOCIAL MARKETING

The step by step approach of social marketing comprises the following components:

- Situation analysis
- Target group segmentation
- Aims
- Marketing Strategy
- Implementation
- Monitoring and evaluation

(Source: Social marketing of traffic safety, OECD, 1993)

In order to show the relevance and practicalities of the approach, a case will be presented: a group of officials wants to promote cycling.

#### Step 1: situational analysis.

In the first step, the *situation analysis*, one concentrates on the presence and characteristics of the object (the State of Art), the context in which one has to operate (enabling or disabling factors) or that influence any intervention; it describes the direction and room of manoeuvres; Four aspects are important: problem analysis, external factors of influence, internal factors of influence and consumer analyses. One could interpret these aspects as follows:

- **problem analysis:** what are the reasons to put cycling on the political agenda? Reasons for this may include the city climate, the inner-city economy, environmental protection, road safety, congestion etc.
- **external factors of influence:** what are the factors that the local administration has limited power or authority over? The policy of the central government regarding modes of transport is one such a field. It may include tax policies; policies of companies regarding transport management; policies of public transport companies; climate conditions etc.
- **internal factors of influence:** what are the conditions in the field of (own) organisation, capacity and instruments? This may also include aspects as political support, time for the development of a bicycle policy and the exchange with citizens and interest groups.
- **consumer analysis:** what are the factors that influence people's choice for the bicycle or another mode? These factors may include aspects of presence and accessibility of modes, costs, safety etc.

On basis of a problem analysis, the local official has to explore opportunities to involve other stakeholders like the central government, private companies, NGO's, citizens and their representative organisations etc. The situation analysis may lead to a first exploration of interventions. These interventions have to be evaluated in relation with identified problems, external influences, the internal factors (mandate and capacity) and the needs and preferences of the consumers.

#### Step 2: target group segmentation.

The second step, *target group segmentation*, is needed because road users are not a homogenous group. Status may be the most important hindrance for some groups to make use of a bicycle, limited access to a bicycle or safety for other groups. In identifying groups of road users, it is important to analyse the social "network" of the target group, like family, friends, colleagues etc.

**Step 3: aims**

The third step regards the *formulation of aims*. They have to be realistic, taken into account all the opportunities and benefits as well as the constraints. Society may benefit very much from a higher share of cycling and create political support for promoting the bike. It is important to analyse whether the allocated budget and planned and implemented interventions are sufficient and effective to achieve the aims. Preferably, the evaluation is made with all relevant stakeholders.

Aims will structure and direct policy and measures. Long term aims may inspire and involve people, whereas short term aims are needed for monitoring progress.

**Step 4: marketing strategy.**

The aforementioned provides us the ingredients for the *marketing strategy*. Now we are able to define the product, the price, the place and the way of promoting.

- the product may be in our case, improved mobility, or more safety, increased health;
- the price may be the price of a bicycle, or an "immaterial" one as getting wet when cycling in rain;
- the place may be the channel by which a product can be obtained, for example a shop, employer or an NGO like Afribike.
- the promotion regards all the information that inform people about the product, price and place.

**Step 5: implementation.**

The fifth step concerns *implementation*. With regard to the means, one has to be flexible and consider the effectiveness of different approaches and measures.

**Step 6: monitoring and evaluation.**

*Monitoring and evaluation* is important to know about effects and to keep in touch with the dynamics of people and society.

**Consumer analysis and external conditions**

Two aspects of the social marketing approach will be explored in more detail hereunder, i.e. consumer analysis and analysis of external conditions. Two illustrations may give some better insight:

1. A few years ago a campaign took place in the Netherlands targeting on car drivers to convince them about the harm cars cause to the environment and the need to restrict car use. The campaign had an opposite effect: most of the drivers developed arguments contra the campaign. The car drivers did not want to change their habit and sought justification for using the car. This makes clear that it is not easy to change attitudes by information campaigns. The determinants of behaviour, the social environment, and target group segmentation were not taken into account.
2. In the Netherlands employers were stimulated to promote bicycle use by their employees. The central government introduced an incentive of excluding the gift of a bicycle (worth about 650 USD) from income tax, if the employee would not receive a compensation for travel expenses for three years.
3. A NGO supporting projects in developing countries, appealed to employers to stimulate the use of a bicycle. The NGO would contribute money to projects dependent on every bicycle kilometre. Calculations made clear that employers would benefit from bicycle use, because of better health conditions of employees and less costs for parking place

The two latter examples that social, economic and technical conditions have been taken into account. As a result people started to cycle for other purposes too (in case 2). People changed not just their practice going by bicycle, but also their attitude towards it.

**Conclusions**

Consumer analysis is an important tool to learn about the behavioural determinants; it helps in identifying feasible opportunities for changing behaviour. Some politicians and officials find that there is no need for bicycle facilities because there are no cyclists. In fact, they assume that there is no

demand for it, which is a different matter. Potential cyclists first want to see that they can use good, safe and comfortable provisions.

People are interested in comfort and technological improvements if that would increase comfort. Their preferences are usually based on money. If the social, technological and economic conditions are not matching, they will resist changes in their behaviour.

## APPENDIX 6

### The concept of negotiated government

(Based on the report: *Onderhandelend bestuur (Negotiated government)*, by B. de Vroom and R. van der Ent, Univ. of Leiden and Ch. Goldenbeld and R. Wittink, SWOV, 1995, SWOV, Leidschendam, the Netherlands).

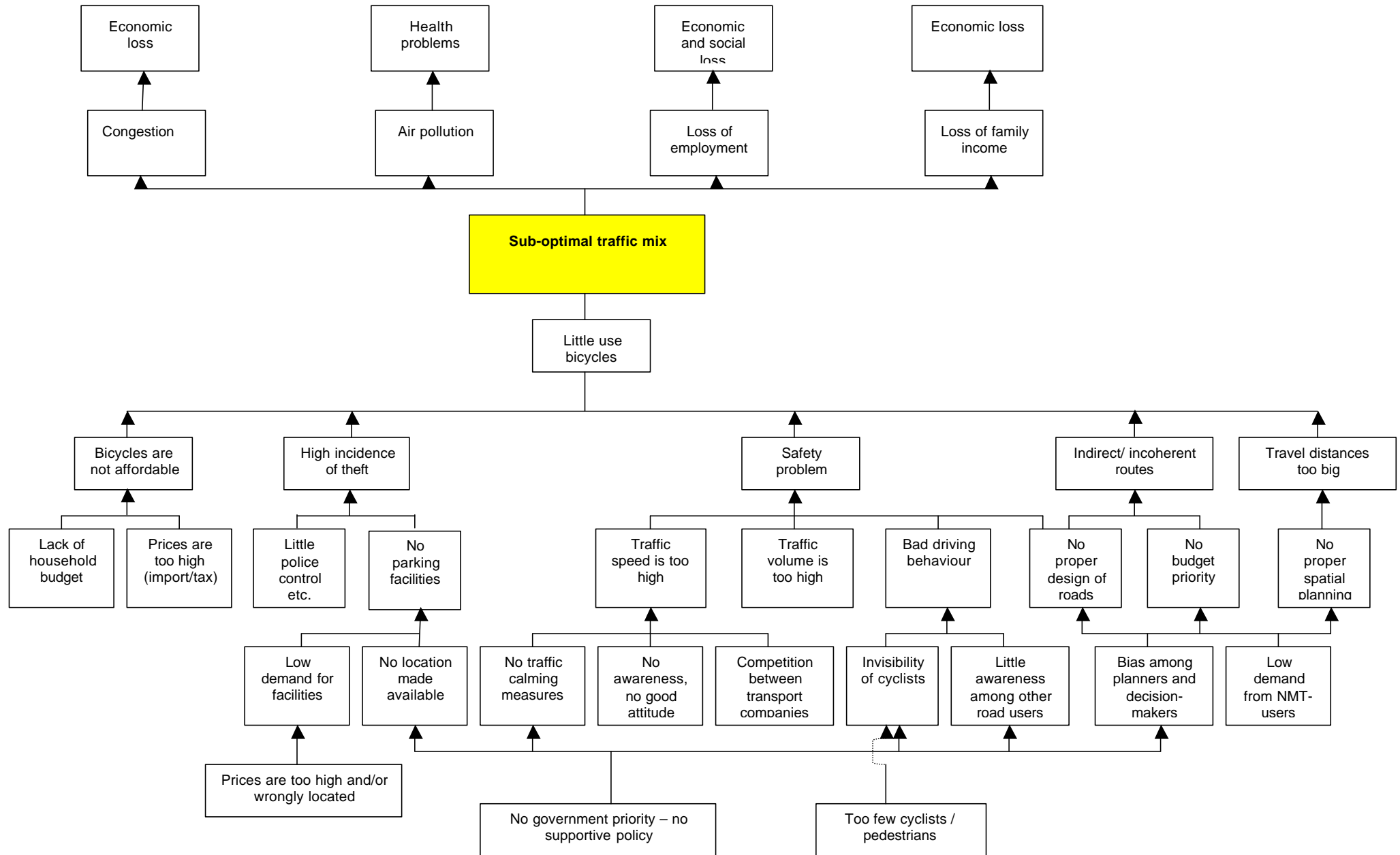
A dialogue between government and the individual citizen has in general little effect. The problems and preferences of citizens are in general too complex and differentiated. Therefore, a platform at meso level is proposed, where government institutions negotiate and exchange with various organised citizens and other social organisations. The platform brings actors together that are dependent from each other in solving a collective problem. The platform formulates a policy as a result of interaction between the participants. No one has the ultimate solution, but the contributions by the different participants will bring the solution near by. The participants learn to know each other interests better and may detect new opportunities for themselves. There is no objective reality independent from the different participants. The reality will develop out of the perceptions and exchange between the participants. This will only happen if they are challenged to make concrete, to put into words and to actualise their own aims. Because the interests remain different, negotiations are necessary to establish cooperation. But the platform will facilitate to reach consensus and compromises.

The local government is the best actor to initiate the process and to formulate the domain and the mandate (responsibilities and in terms of budget and funding) for the platform. Independent experts may help to analyse the collective problems, the social segmentation and the institutional segments, that all together constitute the specification of the domain. The experts may also contribute to the formulation of the target or norms of the platform. On this basis, the participants may be selected.

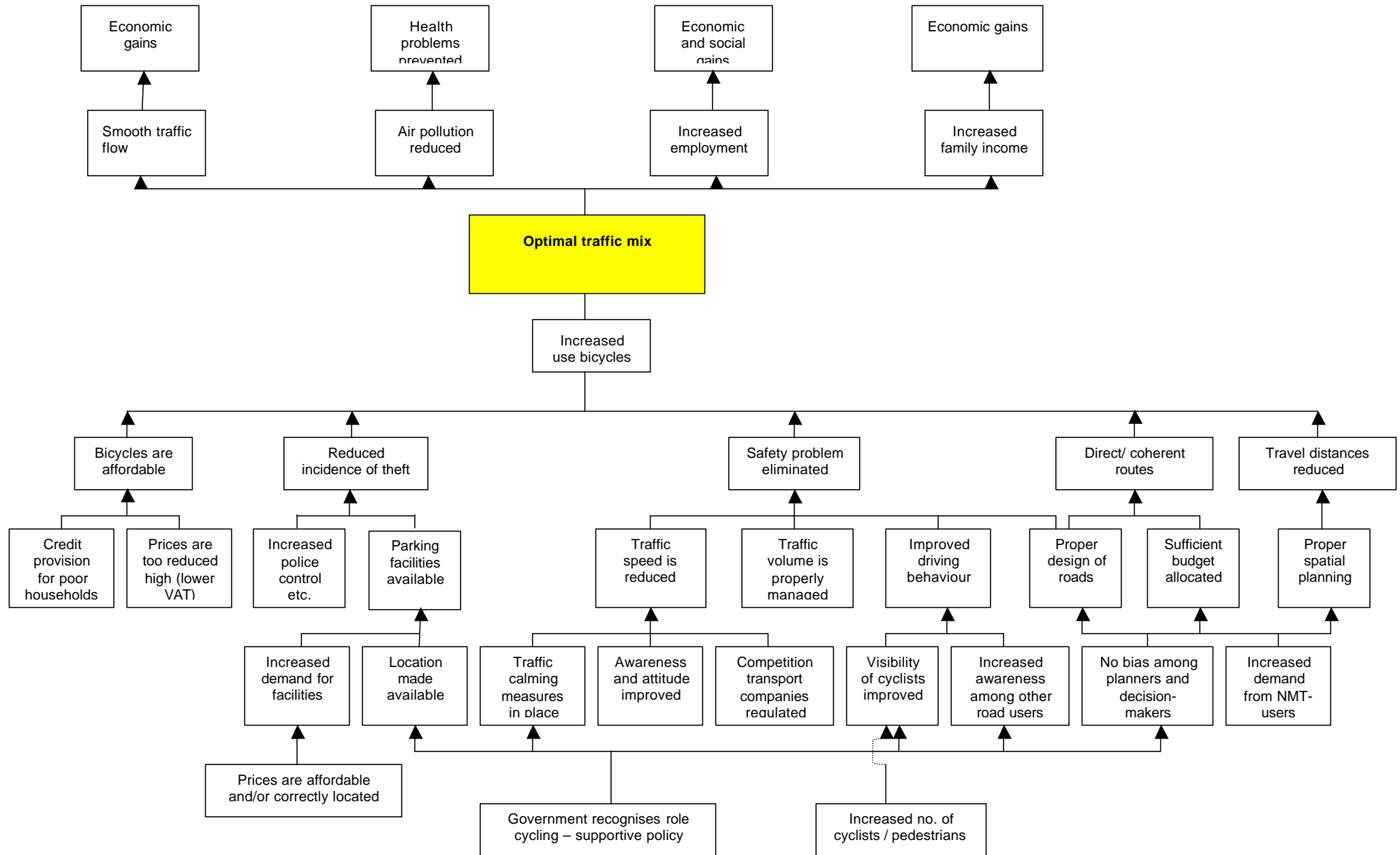
The platform starts with an exchange to define a common sense regarding their problems they want to solve. They will make an inventory of the background of the problems and of alternative behavior that solve these problems. This is the basis to look for measures. It must be clear that the discussion about solutions, for which most people can not easily wait, has to be postponed till an exchange has taken place about problems, the background of problems and targets. Many debates about policies come to a dead stop because they focus only on the measures that every one prefers and the objections the others have.

After the exchange and negotiations a plan of action can be fixed. The measures have to be evaluated and the process of exchange and negotiations will be repeated to improve and extend.

**ANNEX 7: PROBLEM TREE OF BICYCLE USE IN URBAN AREAS IN DEVELOPING COUNTRIES**



**ANNEX 8: OBJECTIVE TREE OF BICYCLE USE IN URBAN AREAS IN DEVELOPING COUNTRIES**



## ANNEX 9: THE DELFT LOW-COST MOBILITY STATEMENT

From 21-23 June 2000, some 80 experts gathered at IHE Delft, The Netherlands, to participate in the World Bank/Velomondial2000/IHE Delft Expert Group Meeting on Low-Cost Mobility in African Cities. The group consisted of politicians, administrators and professionals from African national, provincial and local government levels, NGO representatives, staff from External Support Agencies (ESA's), researchers, consultants and other independent experts. The background materials, presented papers as well as the outcomes of the working group sessions conducted during the Meeting, have been reflected in the proceedings of the Meeting. Those proceedings also contain the below 'Delft Low-Cost Mobility Statement', to which the participants in the Meeting have agreed and committed themselves.

We, the participants in the Expert Group Meeting on Low-Cost Mobility in African Cities,

- recognising the importance of personal mobility for economic and social development, and convinced that affordable mobility is on the critical path to sound economic and social development in Sub-Saharan African Cities, which must include rather than exclude the poor; Concerned that the already low levels of mobility of the urban poor in African cities will decline further with the rapid rate of urbanisation and prevailing urban mobility policies which tend to ignore the mobility needs of the poor;
- recognising the dominant role of walking and (the potential role of) cycling within African towns and cities; Convinced that more efficient and safer walking and cycling positively contribute to poverty alleviation, economic development, health improvement and environmental protection; Referring to Article 150 of the Habitat II Global Plan for Action, which reads: 'Non-motorised transport is a major mode of mobility, particularly for low-income, vulnerable and disadvantaged groups. One structural measure to counteract the socio-economic marginalization of these groups is to foster their mobility by promoting these affordable, efficient and energy-saving modes of transport'; Also referring to article 7.53.c of Agenda 21, which commits governments to 'encourage non-motorised modes of transport by providing safe cycle-ways and foot-ways in urban and suburban centres in countries, as appropriate';
- recognising that these modes have been marginalized in planning, infrastructure provision and traffic management in many African towns and cities, which has resulted in economic losses due to inefficiencies, in economic and social exclusion, and in high economic costs and human suffering as a result of traffic accidents;
- having taken note of the important findings of the Sub-Sahara Africa Transport Programme's Pilot Project on Non-Motorised Transport (SSATP/NMT), which, in summary, are that the mobility and traffic safety of the majority of urban inhabitants can be enhanced substantially through the application of a menu of low-cost and straightforward interventions which yield high investment cost/benefit ratio;

Call upon African national, provincial and local governments, civil society and all other relevant parties, including ESA's, to support and implement the following actions:

### ACTIONS AT NATIONAL AND LOCAL LEVELS

#### Awareness raising

A major stumbling block in realising efficient and affordable mobility in African cities is the lack of awareness amongst politicians, administrators and professionals at national and local levels of the benefits of low-cost mobility options. In order to restore a balance in, and increase the efficiency of the urban transport systems, national awareness raising strategies will need to be developed and implemented. These should target politicians, administrators and professionals at the national and local level, and aim at raising their awareness of the economic and social importance of mobility, of the major role of walking and (the potential for) cycling, of the current inefficiencies of the urban transport systems as regards these modes, and of the ways and means to enhance low-cost mobility.



**Mainstreaming low-cost mobility**

Low-cost mobility has a direct relationship with, amongst others, poverty alleviation, economic and social development, employment generation, urban upgrading and development, and environmental protection. Rather than developing stand-alone low-cost mobility policies, national and local governments are urged to integrate low-cost mobility in policies, strategies, programmes, plans and projects that address these issues. As walking and cycling are an important part of the wider urban transport systems, they should be treated as such. For this reason, national and local governments are urged to include these modes into mainstream urban transport policies, strategies, programmes, plans and infrastructure investment projects. In addition, the requirements for efficient and safe walking and cycling should be included in national urban roads design standards. The draft document 'Productive and Liveable African Cities: Guideline for Pedestrian and Bicycle Traffic' includes relevant proposals for such standards.

**Stakeholder participation**

As is the case in other sectors, stakeholder participation is crucial in the preparation and implementation of sound and equitable policies, strategies, programmes, plans, and projects. National and local governments are urged to credibly involve, as a major group of stakeholders, pedestrians and cyclists in any decision-making process which directly or indirectly relates to their mobility and traffic safety requirements. In doing this, they should pay particular attention to the mobility needs of women, which are particularly affected by inappropriate urban transport solutions.

**Demonstration projects**

Although the validity and applicability of the findings of the SSATP/NMT Pilot Project are beyond doubt, they are based on a limited number of isolated engineering and cycling promotion pilot interventions. The consistent application of the 'menu of interventions' as an output of the pilot project at a large scale, and the monitoring and dissemination of the results thereof, will greatly help in raising awareness of the importance of efficient and safe walking and cycling, and in convincing politicians, administrators and professionals at the national and local levels, as well as the public at large, that this efficiency and safety can be greatly increased at relatively limited costs. For this reason, national and local governments are urged to plan and implement, at city or district level, a number of such demonstration projects in a number of countries, and to disseminate the results within Sub-Saharan Africa.

**Local application**

Independently of, and in parallel with these demonstration projects, local governments can and should make a start with addressing the mobility and safety needs of pedestrians and cyclists, whenever and wherever possible. In doing this, the guidelines produced under the SSATP/NMT Pilot Project are a useful tool, as is the exchange of experience through the network of experts on low-cost mobility.

**Human resources capacity building**

It is recognised that professional leadership capacities (urban planning and management, transport planning and management) are well below what is required, both in quality and in numbers, to prepare and implement sound and equitable low-cost mobility policies for the fast growing African towns and cities. This has undoubtedly contributed to the near exclusion of the requirements of pedestrians and cyclists in urban transport and land-use policies and infrastructure investments. National governments are urged to redress this situation, by providing relevant education and training opportunities, as well as attractive employment conditions, for professionals involved in urban mobility at the national and local levels. In addition, current relevant university level curricula should be upgraded to reflect current thinking about (low-cost) urban mobility, in order to better prepare graduates for their tasks.

**ACTIONS AT THE INTERNATIONAL LEVEL****Mainstreaming low-cost mobility**

ESA's are urged to integrate low-cost mobility in their current and future aid policies and to promote its application in national and local strategies, plans, programmes and projects which they support and which aim at poverty alleviation, economic and social development, employment generation, urban development and upgrading, and environmental protection. They are also urged to provide technical and financial support (both grants and loans) to urban transport plans and projects only if these do justice to the importance and major modal share of walking and (the potential for) cycling in African cities.

**Support to demonstration projects**

The identification, preparation, execution and monitoring of local demonstration projects (see 4. above) will require outside technical and financial support. In this connection, the Low-Cost Urban Mobility Demonstration Programme proposed under the UNCHS Sustainable Cities Programme is a relevant initiative, which qualifies for support by ESA's.

#### **Support to human resources capacity building**

As in many instances existing human resources at the professional level are either very weak or non-existent, national governments will require external support in building human resource capacities and in upgrading relevant university curricula. In view of limited resources and in order to promote regional networking and knowledge sharing, the establishment of a regional 'Centre of Excellence' should be seriously considered. Such a centre could develop and provide training of trainers courses, post-graduate education modules and programmes and assistance to universities in the upgrading of curricula, staff development and strengthening of the related educational/training infrastructure. This Centre could also serve as the coordination unit for a Network of Experts on Low-Cost Mobility which would disseminate experiences and promote exchange amongst professionals working in this field.

#### **Further pilot work and dissemination under SSATP.**

The SSATP/NMT Pilot Project has delivered valuable lessons which are applicable in a large number of situations. Nevertheless, more coordinated pilots should be carried out. The supporters of the SSATP are urged to include a follow-up NMT Pilot Project for additional interventions in its programme of activities. The SSATP is also urged to put in place a programme for much wider dissemination of the findings of the SSATP/NMT Pilot Project, as well as those of follow-up pilot activities and the proposed demonstration programmes. In order to fulfil these activities and to do justice to the crucial role of non-motorised transport in African cities, the SSATP is also urged to ensure that low-cost urban mobility remains a recognisable element within this important initiative.

As participants in the Expert Group Meeting, we commit ourselves to promote the proposed actions, to actively strengthen the network that the Meeting has helped to establish, to keep each other informed of successes and failures in implementation activities, and to meet again in the year 2005 to take stock of progress and to update the plan of action.

Delft, The Netherlands 23d June 2000.

**ANNEX 10:****COST – BENEFIT ANALYSIS OF A BICYCLE POLICY (DUTCH CASE STUDY)<sup>1</sup>**

The reason for inclusion of this CBA is to show an example of how beneficial the bicycle policy can be from an economic point of view. Below we will go into the cost and benefit components. We will conclude annex 10 with a case study from Dordrecht, the Netherlands.

The basic assumption of the calculations made is that due to investments in bicycling infrastructure (paths and parking facilities) the number of short car trips will reduce. It will have a cost reduction effect on car infrastructure since the need to invest in infrastructure is less. Basically, costs can be divided into three categories: costs for municipalities, for the cyclists (internal costs) and for society (external). The costs for municipalities may consist of the construction of bicycle infrastructure and parking facilities, promotion campaigns and loss of parking revenues. For the cyclist the costs are purchase, use and maintenance of the bike. Benefits may accrue for the same groups as for costs. In following table these benefits (and reduced costs) are detailed.

**Table A.10.1: Overview of benefits of bicycle policy**

	Type of costs	Example	Beneficiary
<b>Internal benefits of cycling</b>			
Reduction travel time			Citizens
Quality of life			Citizens
Quality of space			Citizens
Reduction travel costs (car substitution)			Citizens
<b>Internal benefits of guarded bicycle parking facilities</b>			
Reduction bicycle theft			Citizens/Industries
<b>Cost savings of car accommodating policy</b>			
Reducing tear and wear	Maintenance costs		Municipality/province
Spatial occupancy	Land costs		Municipality/industries
Roads and parking space	Construction costs		Municipality/industries
<b>Reduction of external costs car use</b>			
Noise pollution	Prevention costs Evasion costs Damage costs	Silent road surface Rehabilitation	State / municipality State / municipality Citizens
Traffic safety	Prevention costs Evasion costs Damage	Safe traffic provisions	State / provinces / municipalities  Citizens
Air pollution	Prevention costs Evasion costs Damage	Cleaner engines  Environment/health	State / citizens  Citizens / property owners
Stench	Prevention costs Evasion costs Damage		
Congestion	Prevention costs Evasion costs Damage	Time loss	Municipality Citizens / industries
<b>External benefits bicycle policy</b>			
Improved health	Doctor's fee		Citizens
Improved quality of life			Citizens
Improved quality of space			Citizens
<b>External benefits of bicycle parking facilities</b>			

<sup>1</sup> The information and calculations made in this annex, are entirely derived from "Handboek Kosten-Batenanalyse (KBA) Fietsbeleid, by MU Consult B.V. 2000. We kindly refer the interested reader to this manual for more detailed information.

	Type of costs	Example	Beneficiary
Tidy environment			Citizens
Less hindrance pedestrians			Citizens
Less bicycles in front of windows shops			Citizens
Lower insurance premium			Citizens
Less cleaning	Cleaning costs		Municipality

An active bicycle policy will result in two distinct trends: substitution (car by bicycle) and generation (more trips). In other words, total mobility and modal share will change. To estimate its impact, a whole range of formulas should be developed and factors valued. For example, the value of time for business and commuting purposes should be set. Same goes for environmental costs of the emission of CO<sub>2</sub> per kilometre travelled by car. Below, the results are shown.

**Table A.10.2: Costs and Benefits specified and valued.**

	Costs		Benefits	
<b>Municipalities and other authorities</b>	Construction bicycle infrastructure	PM	Revenues parking bicycles	PM
	Construction bicycle parking facilities	PM	Maintenance cost car parking cars and roads	F 0.008 /km
	Information campaigns	PM	Construction costs parking lots for cars	F 2000.00/ unit
	Organisational costs	PM	Change in car infrastructure and functions of roads	F 70.00 / m <sup>2</sup>
	Missed parking fees from cars	PM		
<b>Cyclists</b>	Internal costs additional bicycle traffic	Formula 1	Internal benefits additional bicycle traffic	Formula 2
	Parking fee for cyclists	PM	Savings internal costs for car use	Formula 4
			Reduction of stolen bicycles	PM
			Improved quality of life	PM
			Improved quality of space	PM
<b>Society</b>			Noise pollution	F 0.029/km
			Air pollution:	
			CO <sub>2</sub>	F 0.027/km
			NO <sub>2</sub>	F 0.027/km
			HC	F 0.027/km
			PM <sub>10</sub>	
			SO <sub>2</sub>	F 0.0001/km
			Traffic safety:	
			Fatalities	F 0.024/km
			Injuries	F 0.035/km
			Congestion	F 0.01/km
			Stench	PM
			Reduction of natural resources	PM
			Emissions	PM
			Improved health	PM
		Effects quality of life	PM	
		Less hindrance for pedestrians	PM	
		Less bicycles in front of shop windows	PM	
		Lower insurance premiums	PM	
	<b>TOTAL COSTS</b>		<b>TOTAL BENEFITS</b>	

### CASE STUDY: THE MUNICIPAL BICYCLE POLICY OF THE CITY OF DORDRECHT, THE NETHERLANDS

- Scenario 1: reduction of total short trips (<5.25 km) by car in 2000 with 50% (base year:1994)
- Scenario 2: replacement of short car trips depending on distance by bicycle in 2000
- Scenario 3: reduction of growth of total short car trips from 1989-2000 with 50%; growth is limited to a selected number of origin-destination locations.

The three scenarios will all lead to a reduction in number of kilometres per car (% in top row of table). External effects and costs are given as well for each scenario.

**Table A.10.3: Overview of benefits of bicycle policy in Dordrecht (1993-2000) in million guilders<sup>1</sup>**

		<b>Scenario 1</b> <b>( - 35.5%)</b>	<b>Scenario 2</b> <b>( - 66%)</b>	<b>Scenario 3</b> <b>( - 9.9%)</b>	<b>Beneficiary</b>
<b>External effects</b>	Noise pollution <sup>2</sup>	5.25	6.97	1.05	State
	Air pollution	3.04	5.65	0.85	Public
	Stench	PM	PM	PM	Public
	Congestion	PM	PM	PM	Public/industries
	Traffic safety	17.34	PM	1.32	Public
	Space occupation	PM	PM	PM	Public
<b>Costs for accommodating policy</b>	Reduced maintenance costs car infrastructure	1.68	3.12	0.47	Municipality
	Reduced additional parking costs cars	4.00	7.00	1.00	Municipality/industries
	Reduced costs new car infrastructure	PM	PM	PM	Municipality/province/State
	External revenues bicycle traffic	PM	PM	PM	Public
	<b>TOTAL BENEFITS:</b>	<b>31.31</b>	<b>57.93</b>	<b>7.69</b>	

<sup>1</sup>Costs of promotion campaigns and policy development are not included; same goes for some benefits.

<sup>2</sup>Some benefits are not recurring

## ANNEX 11: ANALYSIS OF EFFECTIVENESS AND EFFICIENCY (CBA) OF TEST INTERVENTIONS IN SSATP

In the study carried out for the World Bank (SSATP), a number of assumptions have been made. In calculations of annuity costs of capital an interest rate of 10% is used. The depreciation period depends on the facility: 10 years in case of small infrastructure/facilities; 20 years in case of bigger infrastructural works (bridges). The valuation of time differs per group and country/city, ranging from 8 to 20 USD cents per hour. The costs of accidents are equal for both Tanzania and Kenya: 3,000 USD for a person killed, 250 USD for a person seriously wounded. The authors point out that these values are rather conservative (low); higher values would improve B/C considerably.

### ANNEX 11.1

Intervention	Unobstructed walkway (in combination with raised zebra crossing)
<b>Description</b>	A narrow side street off the main road in the town centre of Morogoro, Tanzania is an important shortcut for pedestrians for going to the northern part of town. Often, the street is blocked by street vendors or parked vehicles. During the rainy season, the street is muddy. The 2 stages of interventions were: 1) blocking the entrance for cars and constructing raised zebra-crossing at main road to prioritise pedestrians on this route. 2) improving pavement and demarcation for street vendors to stall their business.
<b>Conditions</b>	Motor vehicle speed was 43 km/hr before, but just 16 km/hr on main road after intervention
<b>Problems</b>	<ol style="list-style-type: none"> <li>1. Pedestrian crossing is unsafe. Non-fatal accidents happened regularly.</li> <li>2. Waiting times for vulnerable pedestrians were long.</li> <li>3. The walkways were often blocked by parked vehicles and street traders.</li> <li>4. The pavement of the side street was in bad condition.</li> </ol>
<b>Objectives</b>	<ol style="list-style-type: none"> <li>1. Enable unobstructed pedestrian movement on the walkways, in particular through the shortcut route, and eliminate pedestrian walking on the carriageway</li> <li>2. Create safe traffic conditions at/near this spot, for crossing pedestrians and for cyclists moving on the main carriageway</li> </ol>
<b>Effects</b>	<ol style="list-style-type: none"> <li>1. Obstruction of pedestrian movement by street traders is minimal now; parking of vehicles on the walkway has been eliminated.</li> <li>2. Road safety has been restored at/near this spot.</li> <li>3. Attractiveness of the pedestrian shortcut route has increased.</li> <li>4. Motor vehicle access has been eliminated.</li> </ol>
<b>Costs and benefits</b>	<p><b>Costs:</b> 4,500 USD (including raised zebra)</p> <p><b>Benefits</b> No cost benefit analysis has been calculated for this intervention. It will be comparable to that in annex 11.2.</p>

## ANNEX 11.2:

Intervention	Walkway improvement along a road corridor in Morogoro (Tanzania)
<b>Description</b>	The walkway route improvement package included: a) construction of a separate walkway along the regional hospital fence, separated from the parked taxis and minibuses; b) walkway reconstruction in front of a fuel station and reconstruction of an adjoining Y-construction into a T-shape; c) construction of three traffic calming spots to improve crossing safety (narrowing with bicycle slips at two intersections and speed humps in front of hospital); d) construction of four pedestrian bridges over small streams (open drains); and e) small spot improvements to walkway pavement (filling big holes with compacted murram). All these interventions were directed to solve the urgent problems at specific spots on a route.
<b>Conditions</b>	<ol style="list-style-type: none"> <li>1. The road is one of the most important pedestrian routes in Morogoro, leading from residential areas to city centre. The pedestrian ADT increases as the road gets nearer to the centre, where it reaches about 10,000 per day.</li> <li>2. The traffic on the main carriageway is a mixture of motor vehicles (40% of total) and cyclists (60%).</li> <li>3. The bitumen carriageway is 8-10 meters wide and of fair pavement quality. Total improved walkway section is about 900 meters.</li> </ol>
<b>Problems</b>	<ol style="list-style-type: none"> <li>1. Several dangerous spots where pedestrians have to walk on the carriageway.</li> <li>2. One spot at the regional hospital entrance where pedestrians have to find their way across an area blocked by chaotic minibus- and taxi-parking.</li> <li>3. A dangerous spot with a very long crossing distance (<math>\pm</math> 20 meter), due to the location of a fuel station entrance at a Y-junction.</li> <li>4. Motor vehicle speeds are too high in relation to traffic conditions (&gt;40-50 km/hr).</li> </ol>
<b>Objectives</b>	<ol style="list-style-type: none"> <li>1. create a safe and convenient walking route along this corridor road</li> </ol>
<b>Effects</b>	The public, pedestrians as well as other road users positively received the improvement of the walkway. Fine-tuning of initial improvements increased public appreciation, i.e. to eliminate remaining bottlenecks (a.o. pavement spot repair, protective bollard at the reshaped junction, and walkway re-alignment).
<b>Costs and benefits</b>	<p><b>Costs:</b> Total costs 18,000 USD (12,000 USD for pedestrian bridges and repair existing culverts. Annual cost: 4,200 USD including maintenance)</p> <p><b>Benefits:</b> Pedestrians saving time                      14,400 USD per year (4 minutes/km, ADT 8,000)</p> <p><b>B/C ratio 3.4</b> (not included yet the avoidance of accidents and increased capacity intersection)</p>

## ANNEX 11.3:

Intervention	Raised zebra crossing in Dar es Salaam and Morogoro (Tanzania)
<b>Description</b>	Eleven raised zebra crossings were constructed at the test sites (10 in Temeke (Dar es Salaam) and 1 in Morogoro)
<b>Conditions</b>	A large number of pedestrians cross the road. Approximately 10,000 pedestrians are counted near a specific intersection. The average pedestrian ADT crossing the road at the locations where raised zebra's are constructed is about 2,200. At junctions with wide streets concentration of pedestrians is highest; however, there is no concentrated crossing. During the day motor vehicle traffic ranges from 500 to 1,000 vehicles per hour (peak hour flow of passengers: 15,000 in peak direction). Minibuses stop randomly on the road shoulder to pick up/drop passengers. The estimated average ADT of cyclists on the roads ranges from 1,000 to 2,300.
<b>Problems</b>	<ol style="list-style-type: none"> <li>1. Crossing the road is dangerous for pedestrians, due to high speed of MT.</li> <li>2. The high speed increases the chance of vehicle-vehicle collisions, which if happen, result in damage and traffic delay.</li> <li>3. Cycling is dangerous in mixed traffic due too high speeds of motor vehicles.</li> </ol>
<b>Objectives</b>	<ol style="list-style-type: none"> <li>1. Create a more calm and safe traffic pattern along the entire section, and allowing safe crossing for pedestrians.</li> <li>2. Create crossing points (green points) where crossing is made easy and very safe for the more vulnerable pedestrians (elderly, children etc).</li> </ol>
<b>Effects</b>	<ol style="list-style-type: none"> <li>1. Traffic accidents were nearly eliminated; pedestrians can cross road safely.</li> <li>2. The combination of zebra-crossing and bus bays (adjacent to zebra-crossing) has lead to an increase use of the bus bays.</li> <li>3. Positive for motor vehicle movement: <ol style="list-style-type: none"> <li>a) reduced cost of damage to cars due to accidents</li> <li>b) no significant increase in average transit time of this road section.</li> </ol> </li> <li>4. Negative for operators of large carts since elevation is too high for them.</li> <li>5. The pedestrian waiting times at the raised zebra crossing point are not reduced. The slowing down does not increase the distance between the cars or the willingness to stop for a pedestrian. The zebra's are especially used by the more vulnerable (slower) pedestrians, while others don't cross the street on these places. Since the traffic speed has dropped, it is easier to cross elsewhere.</li> <li>6. The elevation of the road by hump or raised zebra has a significant effect on speed (in Tanzania more than in Europe).</li> </ol>
<b>Costs and benefits</b>	<p><b>Costs:</b> Costs for a raised zebra-crossing amount up to 4,500 USD (annual costs 1,000 USD).</p> <p><b>Benefits:</b> Avoidance of cost of accidents: 4,350 USD</p> <p>Three crossings/km were built at the test section, which led to the elimination of traffic accidents in the year after construction. An average of 12 accidents per year with serious vehicle damage and hospitalisation of 3 pedestrians happened.</p> <p><b>B/C ratio: 1.45</b> (based on cost avoidance only)</p>
Intervention	Painted zebra crossing without speed calming (flat top hump)
<b>Effect</b>	<ol style="list-style-type: none"> <li>1. No change in motor vehicle driver behaviour;</li> <li>2. No change in vehicle speed distribution; V(85%) before = 63 km/hr; after = 64 km/hr.</li> <li>3. No change in number of accidents.</li> <li>4. Still difficult crossing.</li> <li>5. A painted zebra-crossing may suggest a safe crossing, which it is not, and therefore increases the risk of accidents.</li> </ol>



## ANNEX 11.4:

<b>Intervention</b>	<b>Pedestrian route network development (construction walkways, drainage, changing some roads, parking places, upgrading access roads)</b>
<b>Description</b>	The plan area is under rehabilitation: a big market is constructed, attracting other businesses and additional traffic as well. Part of that traffic will be pedestrians and cyclists since trip distances are expected to be short. Moreover, parking for cars will receive attention. For pedestrians safety and speed calming measures will be taken.
<b>Conditions</b>	<ol style="list-style-type: none"> <li>1. A need for simultaneous investments in drainage and walkways.</li> <li>2. A need for upgrading the pavement of most important access roads simultaneously (to reduce severe competition between cars and pedestrians).</li> <li>3. Some shopkeepers will benefit (better access), some will not, because public space will be taken from them.</li> </ol>
<b>Problems</b>	<ol style="list-style-type: none"> <li>1. Too high incidence of transit traffic</li> <li>2. Night time parking of trucks on walkways</li> <li>3. Inefficient traffic flow at key intersections</li> <li>4. Main pedestrian roads do not follow the collector roads, but cross them at right angles. Roads are in a very poor condition.</li> <li>5. Poor drainage system</li> </ol>
<b>Objectives</b>	<ol style="list-style-type: none"> <li>1. Create safe, direct and comfortable access on foot and bicycle to the central part of Temeke from all residential parts of the ward, as part of a good traffic solution for accessibility of the new market and its surrounding area.</li> <li>2. Demonstrate that a good NMT route for the unplanned area at the back of Temeke to the centre can be constructed at modest costs and significantly improves mobility of residents of that area.</li> </ol>
<b>Effects</b>	<ol style="list-style-type: none"> <li>1. Rehabilitation of the neighbourhood and positive image building</li> <li>2. Number of pedestrians can not be assessed yet due to unfinished work</li> </ol>
<b>Costs and benefits</b>	<p><b>Costs:</b> Investment: 70,000 USD (15,000 USD for walkways, 38,000 for drainage, 19,000 for motor-carriageway construction).</p> <p><b>Benefits:</b> Benefits: 4 minutes time saving (per km walkway). Per pedestrian ADT is 1,000, which is 2,000 USD per year. So, break-even traffic for new 4 meter-wide walkway is 2,600 ADT and 3,200 ADT for murrum and concrete slabs respectively.</p>

## ANNEX 11.5:

Intervention	NMT Bridge
<b>Description</b>	Bridge over river is important for reaching school, market and work. It has been constructed and repaired with community participation.
<b>Conditions</b>	<ol style="list-style-type: none"> <li>1. Small river, sandy soil, considerable erosion.</li> <li>2. Users are likely the lower-income classes</li> <li>3. First trial for NMT only (some resistance at the start)</li> </ol>
<b>Problems</b>	Lack of direct routes for NMT
<b>Objectives</b>	Create a good, direct NMT route between Yombo Island and the central part of Temeke.
<b>Effects</b>	<ol style="list-style-type: none"> <li>1. Good and direct NMT route created, without bottlenecks</li> <li>2. Commercial activities have started up along the road.</li> <li>3. Number of users is increasing day by day.</li> <li>4. Community building and building self-esteem.</li> </ol>
<b>Costs and Benefits</b>	<p><b>Costs:</b> Investment: 11,000 USD ; annual cost: 1,500</p> <p><b>Benefits:</b> Benefits: 5 minutes time saving. The detour requires 15 minutes: value of time gain is about 6,000 USD per year. Estimated B/C ration is 4.</p>

## ANNEX 11.6:

Intervention	Road shoulder separation MT-NMT in Dar es Salaam (Tanzania)						
<b>Description</b>	<p>A 500 meter long section of a collector road with previously open shoulder was lined with T-blocks, with a variable distance between them, to test whether leaving wider gaps that allow a car to turn in at a low speed, e.g. for parking, significantly influences the effectiveness of the separation from a pedestrian safety point of view.</p> <p>The chaotic conditions on so-called open road shoulders are creating traffic flow inefficiencies and safety problems, especially in urban areas.</p>						
<b>Conditions</b>	<ol style="list-style-type: none"> <li>1. Urban collector road with a trunk road design (7-meter wide carriageway with 1 meter shoulders).</li> <li>2. The unpaved stretch along the road is 0 to 5 meters wide.</li> <li>3. Frequent movement of motor vehicles on/off the road shoulders. This makes walking and cycling on the shoulders unsafe and unpleasant.</li> <li>4. Random stopping of minibuses (partially) on the shoulder.</li> </ol>						
<b>Problems</b>	<ol style="list-style-type: none"> <li>1. Conflicting uses: where undefined urban road shoulders exist, different activities compete for them: <ol style="list-style-type: none"> <li>a) pedestrian movement</li> <li>b) street trading</li> <li>c) vehicle parking, loading and unloading</li> <li>d) emergency traffic movement</li> </ol> </li> <li>2. Damage to road pavement and drains</li> </ol>						
<b>Objectives</b>	<ol style="list-style-type: none"> <li>1. Separate the carriageway pavement physically from the shoulder, require minimum maintenance, create no drainage or solid waste accumulation, or encourage unintended use of the separators.</li> <li>2. Reshape the road shoulder space into a proper walkway that can also be used by carts.</li> </ol>						
<b>Effects (preliminary)</b>	<ol style="list-style-type: none"> <li>1. Motor vehicle movement onto the shoulders is no longer possible. Pedestrian movements are more "relaxed".</li> <li>2. The number of minibuses stopping at the other spots than bus bays has been reduced to almost zero (also due to simultaneous construction of bus bays at the end of road shoulder separation section)</li> <li>3. Traffic movement in and out of plot entrances along the section does not create significant disturbances.</li> <li>4. The observed damage to T-blocks suggests that the annual maintenance will be around 2-3% of the investment.</li> <li>5. Vehicle top speeds are reduced slightly (visually narrowing the road)</li> </ol>						
<b>Costs and benefits (preliminary)</b>	<p><b>Costs:</b> 10 USD per meter road shoulder (every 3 meters 2 T-blocks for separation). Annual costs are 1.6 USD per meter (including maintenance).</p> <p><b>Benefits:</b></p> <table border="0" style="width: 100%;"> <tr> <td style="vertical-align: top;">Increased value of the road shoulder (walkway)</td> <td style="vertical-align: top;">1 USD person/km/year (15% time-saving) (break-even pedestrian ADT = 1,600. Actual ADT = 5,000 )</td> </tr> <tr> <td style="vertical-align: top;">Reduced cost of pavement maintenance</td> <td style="vertical-align: top;">Results show that even the prevention of serious deterioration of road pavement alone fully justifies the investment.</td> </tr> <tr> <td style="vertical-align: top;">Increased capacity of carriageway</td> <td style="vertical-align: top;">New road is 60 USD per meter. Annual costs are about 12 USD per meter lane. So an increase of 13% in capacity (due to removal obstructions) is already breaking even the investments in T-blocks.</td> </tr> </table>	Increased value of the road shoulder (walkway)	1 USD person/km/year (15% time-saving) (break-even pedestrian ADT = 1,600. Actual ADT = 5,000 )	Reduced cost of pavement maintenance	Results show that even the prevention of serious deterioration of road pavement alone fully justifies the investment.	Increased capacity of carriageway	New road is 60 USD per meter. Annual costs are about 12 USD per meter lane. So an increase of 13% in capacity (due to removal obstructions) is already breaking even the investments in T-blocks.
Increased value of the road shoulder (walkway)	1 USD person/km/year (15% time-saving) (break-even pedestrian ADT = 1,600. Actual ADT = 5,000 )						
Reduced cost of pavement maintenance	Results show that even the prevention of serious deterioration of road pavement alone fully justifies the investment.						
Increased capacity of carriageway	New road is 60 USD per meter. Annual costs are about 12 USD per meter lane. So an increase of 13% in capacity (due to removal obstructions) is already breaking even the investments in T-blocks.						

## ANNEX 11.7:

Intervention	Median in Eldoret (Kenya)
<b>Description</b>	The construction of a median on both sides of a bridge over a total length of 60 and 160 meter intended to make overtaking impossible.
<b>Conditions</b>	<ol style="list-style-type: none"> <li>1. Wide carriageway (10 meter in the approaches, 9 meter at the bridge)</li> <li>2. Fair bitumen pavement</li> <li>3. High vehicle speed. Inbound: <math>V(85\%)=47.5</math> km/hr, maximum 82 km/hr. Outbound: <math>V(85\%)=50.5</math>, while the recorded maximum is 72 km/hr.</li> <li>4. Most drivers have little concern for the safety of pedestrians and cyclists.</li> </ol>
<b>Problems</b>	<ol style="list-style-type: none"> <li>1. High speed of vehicles.</li> <li>2. The road slopes upward on both sides after the bridge. Overtaking is dangerous, with cyclists and pedestrians on the carriageway.</li> <li>3. Absence of walkways. Pedestrians use the edge of the carriageway.</li> </ol>
<b>Objectives</b>	<ol style="list-style-type: none"> <li>1. Restore smooth and safe traffic flows and eliminate the spot as a black spot for pedestrians and cyclists.</li> <li>2. Facilitate safe pedestrian crossing on both sides of the bridge, without imposing one single crossing point.</li> </ol>
<b>Effects</b>	<ol style="list-style-type: none"> <li>1. Restored traffic safety. Where previously this was the most dangerous section, it is now probably the safest.</li> <li>2. Vehicle speeds (inbound) went down from <math>V(85\%)=47.5</math> to 21.0, and the highest observed speed from 82 km/hr to 35 km/hr. Outbound similar changes occurred.</li> <li>3. The volume of cyclists increased 13% in the 3 months after opening (180 cyclists per day, inbound; same weather conditions). This is probably a modal shift from minibus to bicycle.</li> </ol>
<b>Costs and benefits</b>	<p><b>Costs:</b>  Costs of this median: 21,000 USD (annual costs: 4,500 USD)  These costs cover the complete reshaping of the bridge section (including medians, pedestrians and bicycle tracks, drains and raised crossing). Cost for median = 25 USD per meter.</p> <p><b>Benefits:</b>  Reduction in costs of accidents: 5,500 USD per year (estimation)  Increase in modal share of cycling (cost saving): 10,000 USD per year (250 days*180 cyclists*0.23 USD) per year</p> <p>B/C ratio (reduction costs accidents): 1.2  B/C ratio (change modal share): 2.3</p>

## ANNEX 11.8:

Intervention	Mixed NMT track along an urban corridor in Eldoret (Kenya)
<b>Description</b>	Construction of 390 meter of separate mixed NMT track (2.5 meter-wide, premix pavement), two pairs of two speed humps, repairs to drainage culverts, construction of one crossing island where the track crosses a side street, road signs and painting.
<b>Conditions</b>	<ol style="list-style-type: none"> <li>1. Maximum vehicle speed from outside town is 70-90 km/hr. Should be reduced to about 50 km/hr.</li> <li>2. Substantial number of heavy truck combinations on long distance trips.</li> <li>3. Fair pavement condition.</li> <li>4. ADT (12 hr count) at critical intersection is: MT 10,200; cyclists 4,200 and pedestrians 15,800. Motor vehicle speed was 43 km/hr before, but just 16 km/hr on main road after intervention</li> </ol>
<b>Problems</b>	<ol style="list-style-type: none"> <li>1. High number of accidents with pedestrians and cyclists involved</li> <li>2. No walkway for pedestrians; no safe road-crossings</li> <li>3. Cyclists share the carriageway with MT, but in view of the high speed of motor vehicles and the interference with pedestrians this is unsafe.</li> <li>4. The MT carriageway does not yet reach saturation in the peak hour, but the expected increase of MT and bicycle traffic can not be accommodated on the existing road space in the long run.</li> </ol>
<b>Objectives</b>	<ol style="list-style-type: none"> <li>1. Significant reduction of accidents</li> <li>2. Provision of adequate road capacity for both MT and cycling</li> <li>3. Improve attractiveness of cycling and walking.</li> </ol>
<b>Effects</b>	<p><b>For pedestrians:</b> Most pedestrians use the track in both directions. After completion of the mid-block crossing protected by speed humps, the use of the track by pedestrians improved further, since it turns out to be safe now to cross.</p> <p><b>For cyclists:</b> Most cyclists continue to use the carriageway. A week of active publicity and instruction of cyclists at the site, urging them to use the track, did not change the situation, because:</p> <ol style="list-style-type: none"> <li>1. obstruction of the track by pedestrians</li> <li>2. the track requires a little detour and is still short (400 meters)</li> <li>3. the speed has reduced much on the carriageway, so that the overall safety has even improved.</li> </ol> <p>What was meant to be a bicycle facility, turns out to have become a safe walkway. The design of the track was actually not adequate to serve both cyclists and pedestrians in both directions. For that, a much broader and separate track is required.</p> <p><b>Safety:</b> After the construction no fatal accidents occurred over a period of one year. The year before construction 6 fatal accidents did happen.</p> <p><b>Road capacity:</b> Though cyclists are using the carriageway, the overall situation has improved and capacity is satisfactory for both MT and cyclists. The road is 9 meters wide and offers now enough space; a next adjustment to the road profile is suggested: a painted bicycle lane.</p> <p><b>Attractiveness:</b> Attractiveness has increased since the black spot (unsafe) has been eliminated.</p>
<b>Costs &amp; Benefits</b>	<p><b>Costs:</b> 25,000 USD (5,300 USD annual costs); per meter track length is 27 USD.</p> <p><b>Benefits:</b></p> <p><b>Enhanced cycling:</b> Annual saving on travel cost (bus fee) 7,000 USD (per 100 former bus takers) Expected increase in cyclist 200 persons.</p> <p><b>Reduced costs of accidents:</b> Estimated reduction of fatalities is 5 per year. The associated reduction in costs of accidents is then 15,000 USD (excluding costs of vehicle damage, administration, congestion due accident). B/C ratio: &gt; 4</p>

## ANNEX 11.9:

Intervention	Bus bays in Dar es Salaam (Tanzania)
<b>Description</b>	The intervention consisted of the construction of two pairs of long bus bays, 3 meter wide, with a brick pavement. Pedestrian areas raised, separated from the bay by high kerbs, and paved (slabs), with shelter, either constructed or by trees. Furthermore, raised zebra crossings were constructed at the same locations. Separation between carriageway and shoulders to discourage random stopping has also been implemented.
<b>Conditions</b>	<ol style="list-style-type: none"> <li>1. Passengers see little benefit in going to a bus stop to wait there, because the bays are not more attractive than any other spot.</li> <li>2. Bus drivers look for passengers everywhere, and so reducing attention to safe driving.</li> <li>3. The shape of the road allows stopping at any particular point.</li> </ol>
<b>Problems</b>	Frequent and unpredictable manoeuvres of buses to pickup or drop passengers, which creates an inefficient traffic flow and unsafe traffic conditions for pedestrians, cyclists, motor vehicles and bus passengers.
<b>Objectives</b>	Find a way of making bus bays so attractive to use, for both bus drivers and passengers, and stopping at other points so unattractive, that the large majority of all passengers is picked up from, or dropped at the bus bay.
<b>Effects</b>	<ol style="list-style-type: none"> <li>1. From comparable test cases in Dar es Salaam, the following effects are achieved: <ol style="list-style-type: none"> <li>a) Provision of bus bays alone leads to a situation where on average 25-30% of bus stops is in those bays, the remainder still outside.</li> <li>b) Provision of bus bays, combined with raised zebra crossings (traffic calming at the location of the bay) and paving of the pedestrian waiting area leads to 70-75% of bus stops being in those bays.</li> <li>c) Road shoulder / carriageway separation in addition to the bays, increases the percentage of stops in bays. Monitoring is ongoing to check the longer-term performance of the combination of bus bay, raised crossing, road shoulder separation.</li> </ol> </li> </ol>
<b>Costs and benefits</b>	<p><b>Costs:</b> Total costs: 20,000 USD per set of bays (bay area, pedestrian waiting area, crossing); annual costs: 4,300 USD. For a whole bus route in Dar es Salaam (like the Temeke-Posta) it will cost 85,000 USD. Total number of travellers is about 8 million, paying 1.8 million USD for bus fare.</p> <p><b>Benefits:</b> To be expected from reduced maintenance buses, petrol saving, reduction in turn-round time, and avoidance of accidents.</p>

## ANNEX 11.10

Intervention	Bicycle track along urban corridor in Eldoret (Kenya)
<b>Description</b>	Construction of a 500 meter long bicycle track along an existing road by rearranging the parking and traffic lanes. The track is on the existing carriageway pavement, separated from the parking lane by high kerbs. The road had a transit and centre function. The wide road (16 meter; 2x2 lane) was in reasonable condition. Due to angular parking and occupation of sidewalk by vendors and shopkeepers, the main road was actually narrow, offered limited overview, and was used by cyclists and pedestrians as well.
<b>Conditions</b>	<ol style="list-style-type: none"> <li>1. Irregular parking spoils the efficiency and safety of the road.</li> <li>2. Through-traffic of heavy truck significantly adds to traffic hazards.</li> <li>3. Fair bitumen pavement.</li> <li>4. Insufficient pedestrian walking capacity (in view of pedestrian volume).</li> <li>5. ADT pedestrians 17-20,000; ADT cyclists: 2,500-5,000; ADT MT 8-12,000.</li> <li>6. Peak crossing volumes at main junctions: 3-3,500 per hour, cyclists: 200-35- per hour.</li> </ol>
<b>Problems</b>	<ol style="list-style-type: none"> <li>1. Very unsafe bicycle and pedestrian traffic along the main road corridor in Eldoret. 1995: 10 cyclists and 30 pedestrians were killed; 18 cyclists and 55 pedestrians seriously injured.</li> <li>2. Inefficient use of existing motor carriageway.</li> <li>3. Very inefficient (slow) walking conditions.</li> </ol>
<b>Objectives</b>	<ol style="list-style-type: none"> <li>1. Create a safer and more efficient traffic flow for cyclists</li> <li>2. Improve the attractiveness of cycling, and reinforce the user confidence that cycling will be safeguarded in the long term as a viable mode of transport by Eldoret authorities.</li> <li>3. Increase the efficiency and capacity of the MT flow, to demonstrate that a win-win solution is possible.</li> </ol>
<b>Effects</b>	<ol style="list-style-type: none"> <li>1. The new bicycle track remains free of parked vehicles; the separation of bicycles and motor vehicles with high kerbs is effective.</li> <li>2. The inability of providing pedestrians unhindered walking on the walkways results in pedestrians using the new bicycle facility, whereas cyclists move out to the carriageway. Safety and attractiveness for pedestrians increased significantly, though not planned this way.</li> <li>3. Parking is parallel to traffic flow now, creating a much smoother and safer traffic flow.</li> <li>4. The total current motor vehicle capacity of the corridor is determined by the capacity of the intersections, of approximately 1,000 vehicles/hour in each direction. On the straight sections that capacity can easily be provided by means of one motor vehicle lane. It means that there is no capacity problem when rearranging the existing road into one wide single motor traffic lane and one bicycle lane. Additional measures at the intersections are necessary.</li> </ol>
<b>Costs and benefits</b>	<p><b>Costs:</b> Total cost of redesigned bicycle track is 18,000 USD (600 meter track including separators, but no pavement since already existing as part of carriageway). Annual costs: 3,900 USD.</p> <p><b>Benefits:</b> Pedestrians:<sup>1</sup> 6,000 USD/year (1,20 USD per pedestrian / year) Cyclists:<sup>2</sup> 4,000 USD/year ( due to some avoided costs of accidents) 14,000 USD/year (due to halting reduction of cyclists on this stretch = 300 days*200 cyclists*0.23 USD cents/day)</p> <p>B/C: 1.5 (in case of pedestrians) and 4 – 5 (in case of cyclists)</p>
	<p><sup>1</sup>Due to increased walking speed on “planned” bicycle track, assuming 50% of walks are long-distance. <sup>2</sup> In case cyclists win “authority” over the bicycle track.</p>

## ANNEX 11.12:

Intervention	Bicycle route network planning and design in Morogoro (Tanzania)																										
<b>Description</b>	The bicycle network plan has been adopted by the municipality as part of the “urban mobility plan”, to become an ingredient of its transport policies for the next decade and in particular for its priorities in a number of road rehabilitation plans now in preparation. First step in process is to plan the desired future bicycle route network. Second step is to provide design recommendations for the required bicycle infrastructure of different types of roads. Third step is to make detailed proposals for bicycle infrastructure on the roads in the rehabilitation projects.																										
<b>Conditions</b>	<ol style="list-style-type: none"> <li>1. Separated bicycle tracks outside the city centre, on main cycle routes. Since building density is low, speed reduction is not desirable. Therefore separate tracks must be constructed to ensure safety for cyclists.</li> <li>2. Bicycle lanes in the city centre, visually separated from MT. Here, the average speed must be reduced to about 30 km/hr due to building density, number of pedestrians and function of road. No need for separation; mixing MT with cyclists is no problem.</li> <li>3. Bicycle route network density (to be increased after positive effects related to cycling)</li> </ol>																										
<b>Problems</b>	<ol style="list-style-type: none"> <li>1. Bicycle traffic has not been taken into account in road designs.</li> <li>2. Worsening of the traffic safety for cyclists due to too high MT speed and lack of bicycle road facilities.</li> <li>3. Cycling is becoming less popular due to unsafety.</li> <li>4. Household expenditures for transport will rise and mobility will decrease.</li> </ol>																										
<b>Objectives</b>	Design and implement a bicycle route network with the capacity to accommodate up to 40% of all urban trips in the long term, offering safe traffic conditions and direct routes.																										
<b>Effects</b>	Project under implementation																										
<b>Costs and benefits</b>	<p>Bicycle track per km: 20,000 USD (annual cost 4,200 USD including maintenance) Bicycle lane per km: 20,000 USD (annual cost 4,200 USD including maintenance) Motor traffic lane per km: 60,000 USD (annual cost 12,600 USD including maintenance)</p> <p><b>Estimated minimum infrastructure cost per passenger km per year:</b></p> <table> <tbody> <tr> <td>Separate cycle track (2,0 meter)</td> <td>0.16 USD cent per passenger / km</td> <td>ADT 9,000</td> </tr> <tr> <td>Mixed traffic cycle lane (1.5 meter)</td> <td>0.28 USD cent per passenger / km</td> <td>ADT 5,000</td> </tr> <tr> <td>MT lane (3,0 meter, 75% bus)</td> <td>0,07 USD cent per passenger / km</td> <td>ADT 60,000</td> </tr> <tr> <td>MT lane (3,0 meter, 25% bus)</td> <td>0.14 USD cent per passenger / km</td> <td>ADT 60,000</td> </tr> </tbody> </table> <p><b>Estimated operating cost per passenger km (Tanzania, Kenia, 1998)</b></p> <table> <tbody> <tr> <td>Bicycle</td> <td>1 USD cent per passenger / km</td> </tr> <tr> <td>Minibus</td> <td>3 USD cent per passenger / km</td> </tr> <tr> <td>Car</td> <td>20 USD cent per passenger / km</td> </tr> </tbody> </table> <p><b>Total cost:<sup>1</sup></b></p> <table> <tbody> <tr> <td>Bicycle on bicycle track</td> <td>1.3 USD cent per passenger / km</td> </tr> <tr> <td>Bicycle on bicycle lane</td> <td>1.6 USD cent per passenger / km</td> </tr> <tr> <td>Minibus (75%)/car (25%), mixed</td> <td>4.9 USD cent per passenger / km</td> </tr> <tr> <td>Car (75%)/minibus (25%), mixed</td> <td>10 USD cent per passenger / km</td> </tr> </tbody> </table>	Separate cycle track (2,0 meter)	0.16 USD cent per passenger / km	ADT 9,000	Mixed traffic cycle lane (1.5 meter)	0.28 USD cent per passenger / km	ADT 5,000	MT lane (3,0 meter, 75% bus)	0,07 USD cent per passenger / km	ADT 60,000	MT lane (3,0 meter, 25% bus)	0.14 USD cent per passenger / km	ADT 60,000	Bicycle	1 USD cent per passenger / km	Minibus	3 USD cent per passenger / km	Car	20 USD cent per passenger / km	Bicycle on bicycle track	1.3 USD cent per passenger / km	Bicycle on bicycle lane	1.6 USD cent per passenger / km	Minibus (75%)/car (25%), mixed	4.9 USD cent per passenger / km	Car (75%)/minibus (25%), mixed	10 USD cent per passenger / km
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<sup>1</sup> assuming a capacity utilisation of infrastructure of 50% (ADT = 3X peak capacity)

From this table it can be concluded that:

1. travel costs are much higher than those for infrastructure.
2. investment in roads predominantly used by full minibuses are the lowest per passenger/km.
3. the travel and infrastructure costs for motorised transport are still 4 to 8 higher compared to bicycles

Calculations show that when investing in bicycle infrastructure (which is more expensive than for MT), the cycle track still creates a cost savings per year of about 35% (1,600 USD) of total annual cost of bicycle infrastructure.