Division 44
Environment and Infrastructure
Sector Project „Transport Policy Advice“

Training Course:

Non-motorised Transport

Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH

commissioned by:

Federal Ministry
for Economic Cooperation
and Development

Training Course

Non-motorised Transport

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Commissioned by
Bundesministerium für wirtschaftliche
Zusammenarbeit und Entwicklung (BMZ)
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Cover Photo:
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Bogotá, Colombia
2004

Layout:
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Eschborn, August 2005

Preliminary remarks

Since this training material has to be seen as integral part of GTZ's publications on sustainable urban transport (see *Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities*, and further training material on subjects such as Mass Transit and Bus Regulation and Planning) special reference is made on Module 1a of the Sourcebook "*The Role of Transport in Urban Development Policy*". Module 1a describes different ways of living in cities, visions for its citizens, the interrelation between urban development, liveability, environment and infrastructure. Non-motorised planning and regulation play a crucial role for implementing the city of the future. It has been written by Enrique Penalosa, the former mayor of Bogotá. For details of his policy-model, please see http://www.porelpaisquequeremos.com

1. Benefits of a greater role for non-motorised transport

1.1. Advantages of non-motorised transport

Many developing cities have implemented policies which reduce the appeal of cycling, encouraging people to travel by motorised means even for short trips. However, an increasing number of city governments in developed and developing cities have recently begun actively promoting bicycling and walking.

Pedestrians, bicyclists, and cycle rickshaw passengers generate no air pollution, no greenhouse gases, and little noise pollution

Reducing emissions and noise are critical to slowing global warming, reducing incidents of asthma and other upper respiratory and cardio-vascular disease, and reducing sleep disorders. In both developed and developing countries, upper respiratory illnesses, particularly asthma, are increasing dramatically. While emission standards and cleaner vehicles can greatly reduce certain emissions, reducing carbon dioxide, nitrogen oxides, and ground level ozone through tailpipe-focused measures alone is proving exceedingly difficult. These emissions are growing rapidly in most developing country cities as the use of motor vehicles increases. Sleep deprivation is also a problem of growing seriousness, the medical significance of which is only beginning to be understood.

Bicyclists and pedestrians are more efficient users of scarce road space than private motor vehicles, helping to combat congestion

While fully occupied public transit vehicles are the most efficient users of road space, bicyclists use less than a third of the road space used by private motor vehicles, and pedestrians use less than a sixth. Even cycle rickshaws use considerably less road space per passenger than motorised taxis and single occupancy private motor vehicles (see box below). The space needed to park bicycles is even 15 times less than the space needed to park a car alongside the road.

Bicycling and walking are the most efficient and environmentally sustainable means of making short trips

In most developing cities, average trip distances are extremely short. Often over 60% of trips are under 3 kilometres long. In well planned German cities, over 80% of trips under 3 kilometres would be made by walking or bicycling, generating no pollution and minimal traffic congestion. Surabaya, for example, is only 15 kilometres north to south. This means virtually no trip inside the city is too far for an average healthy cyclist's average commute.

In Bogotá, in 1998 70% of the private car trips were under 3 kilometres. Even though this percentage is lower today thanks to the bike and pedestrian facilities, it is still too high compared to some Northern European cities.

Arterial in aipei: 14,000 passengers per hour

Arterial in Kunming: 24,000 passengers per hour

M. Traber, EWE

1.2. Non-motorised transport: neglected by design

In Asian cities, however, even with per capita incomes less than one-twentieth of Germany, over 60% of these short trips under three kilometres are made by motor vehicles, usually motorcycle, moped, or paratransit (see Figure 1).

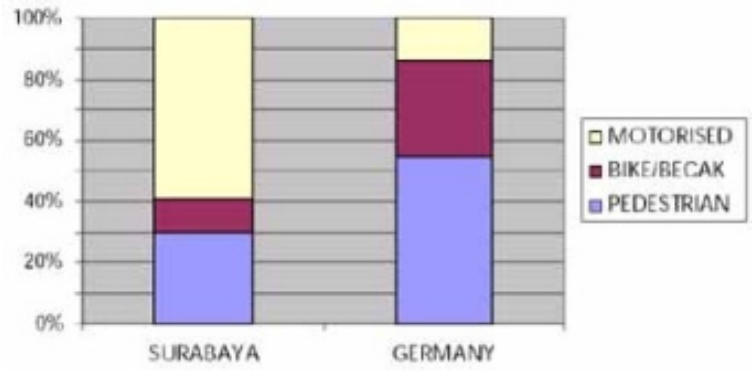


Fig. 1: Mode split for trips between 1km and 3km, Surabaya, Indonesia, compared to Germany

GTZ & ITDP 2000

Our studies indicate three reasons for this:

1. Few pedestrian or cycling facilities have been provided in many cities. Over 60% of the roads in Jakarta, for example, have no sidewalks, and those that exist are heavily obstructed by telephone poles, trees, construction materials, trash, and open sewer and drainage ditches (see Figure 2).
2. Secondly, the traffic system has been designed to increase motor vehicle speeds, at the expense of pedestrian and bicycle safety. Many Asian cities make minimal use of traffic lights with zebra crossings and medians which provide a place for pedestrians to cross safely. As a result, the number of roadway fatalities per vehicle is many times higher than in Europe or the US.
3. Finally, pedestrian barricades and one way streets have been used to facilitate long distance motorised trips but which simultaneously impose huge detours for short distance cycling and pedestrian trips (see Figure 3 for an example from Surabaya). People wishing to cross a main shopping street often find it easier to take a taxi two kilometres than to walk across the street. In Surabaya, a World Bank financed study estimated that these measures generate an additional daily 7000 kilometres of needless vehicle traffic.

Fig. 2: Narrow, obstructed walkway in Hyderabad forces pedestrians onto the street, consuming a full lane of road space.

Walter Hook, ITDP

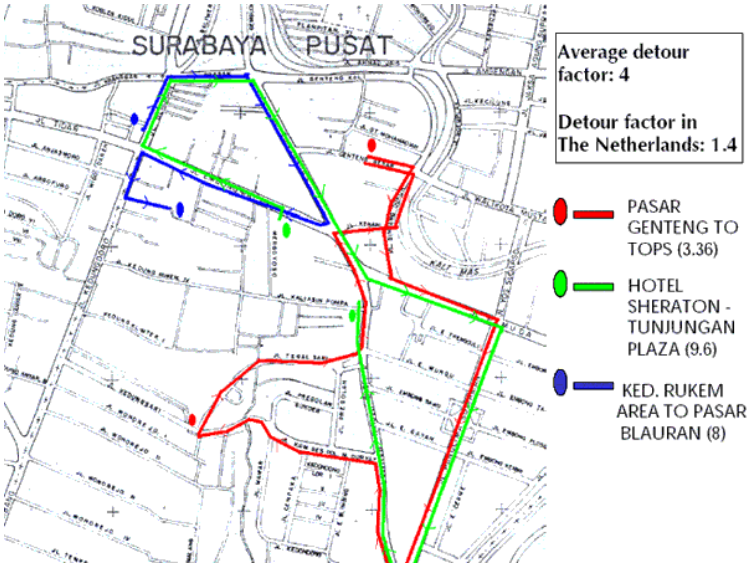


Fig. 3: Detour factors in central Surabaya

Most people feel that culture and heat are reasons for low levels of cycling in parts of the developing world where cycling is no longer ubiquitous. In terms of heat, average temperatures in Asia are not significantly higher than summer temperatures in Europe when cycling trips are at their peak. Streets need to be designed to provide shade and pavements that do not radiate heat. Cultural factors are clearly involved, but cycling culture did not happen overnight anywhere. In Holland the cycling culture has long historical roots, but the dramatic increases in cycling in the last two decades resulted from concerted government efforts. Use of the Mayor's Office as a 'bully pulpit' in Bogotá coupled with the construction of extensive cycling paths has resulted in an increase of cycling from 0.5% of daily trips to 4% of daily trips in only 3 years.

1.3. Economic benefits of non-motorised transport

Improving the efficiency of non-motorised travel is economically vital

Virtually every trip begins and ends with a walking or cycling trip, whether between a parking lot and an office building or a home and a bus station. Because walking trips and cycling trips are very slow, inefficiency in making these trips, forcing people to walk or bicycle a long way out of their way, has very high economic cost because of the slowness of travel by these modes. At three kilometres per hour, having to walk a kilometre out of your way adds 20 minutes to a trip. In some countries it now takes as long for people to walk from their homes to the nearest bus stop as it takes to fly from Sao Paulo to Rio de Janeiro. Similarly, new studies of modern logistics indicate that the cost of making the last link in the supply chain – namely from the store to the consumer - costs as much as shipping products half way around the world. These studies indicate that the efficiency of short distance travel is much neglected and of critical economic importance.

The use of NMVs to transport goods is also economically significant as an important part of the supply chain in many cities.

Full pedestrianisation of downtown commercial areas has been observed in Chinese, Colombian, European, Brazilian, and other cities to dramatically increase the profitability of shops in the area, and has led to an increase in land values.

Nanjing Road, Shanghai was recently pedestrianised and is one of the highest rent districts in China. Walter Hook, ITDP

Non motorised goods transport

Source: Niklas Sieber, GTZ

In urban areas non-motorised vehicles (NMVs) are not only relevant for the movement of people, but also for the transport of goods. In many African towns handcarts are used to transport goods to and from markets. This can be done either by the seller or by a small scale entrepreneur as a service provision for the customer. In Asia, rickshaws designed for passenger transport are often used to transport goods in towns (as for example in the picture below).

Hanoi, February 2002 Manfred Breithaupt

(taken from GTZ Photo CD 1)

Non motorised goods transport is often important for intermodal goods transport. Farmers often carry their produce with buses to the market town and than load them onto NMVs. Bottlenecks occur when loading facilities are non-existent or inadequate and unloading on the road causes traffic jams around bus stops. Additionally, often little or no space is provided for NMVs around markets.

These types of non motorised transport services are in most cases offered by small scale entrepreneurs, which underlines the economic viability of these NMVs. They are not only essential for urban goods transport, but are also important for the urban economy, because they give employment to many drivers and entrepreneurs. As a matter of course, these types of jobs are mostly taken by poorer citizens.

Niklas Sieber

A special form of rickshaw is used in Bangladesh, the bicycle van, which has basically the same design as a rickshaw, only the back (load area) is designed to carry goods. Using this vehicle, a human is able to transport up to one metric ton on a flat terrain without the aid of an engine. Most bulky goods are transported by rickshaw vans; not only goods to and from markets, but also raw materials and products of small-scale industries. The abundance of rickshaw vans in Bangladesh towns shows the economic importance of this mode for the local economy.

A freight rickshaw in Suzhou, China
Jan. 2002 Karl Fjellstrom
(taken from the GTZ Photo CD 2)

Economic benefits of planning for cycling

Contributed by Roelof Wittink, I-ce

I-ce calculated the economic value of planning bicycle facilities in four cities, one of which was Bogotá.

The costs of building bicycle tracks, their maintenance as well as promotion and education campaigns were calculated to be US$178 million over a period of 10 years. The construction costs of one kilometre of high quality bicycle track were about US$200,000.

Cost savings from reduced infrastructure needs, reduced congestion and reduced pollution due to the replacement of car kilometres over 10 years amount in total to US$492 million, of which more than 50% results from saved parking spaces.

Road safety is expected to be improved by 50%, based on experiences abroad. This results in savings with an economic value of US$643 million.

Savings in running costs for road users by not using a car or a bus amount to US$167 million.

The overall result is that the benefits have an economic value of US$1302 million over 10 years, compared to US$178 million costs. The benefits are 7.3 times higher than the costs.

Please also see this illustration of the costs and benefits of bicycle lanes.

Costs and benefits of bicycle lanes in Bogotá.

For further information visit: www.cycling.nl

The Economic Significance of Cycling; VNG/I-ce; The Hague/Utrecht; 2000.

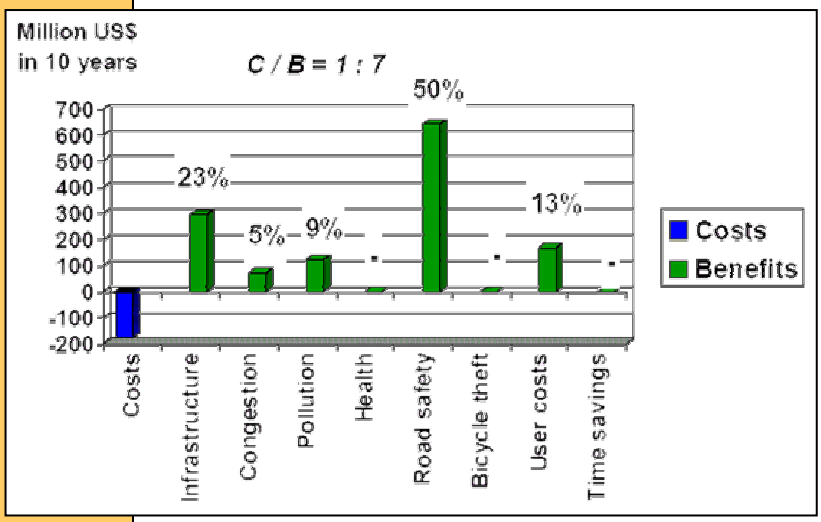
Increasing the modal share of bicycling and walking can reduce a country's dependence on imported oil.

Many developing countries are going deep into debt to continue subsidising oil, which is overwhelmingly used by higher income motorists. The Indonesian government up to 2001 spent more than $4 billion annually to prop up these unsustainable fuel subsidies. (These fuel subsidies have been considerably reduced by the current government since early 2002, through a series of price rises.) The volatility of oil prices, and the risk of diminishing global reserves over the next two decades, make a reduced reliance on oil critical to avoiding serious exogenous economic shocks to the national economy.

1.4. Investments for the poor

Promoting safe bicycling and walking in order to improve the accessibility of the poor

In some developing country megacities, reaching centres of employment from low income settlements is an arduous journey consuming over one quarter of a family's disposable income and more than 4 hours each day. For trips less than 3 kilometres, the poor of Surabaya are already more dependent on motor vehicles than Germans, who have incomes 40 times higher. This is imposing an enormous, needless burden on the poor, and inhibiting their ability to participate in the



Costs and benefits of bicycle lanes in Bogotá

workforce, as well as gain access to education and health care. Viable and safe walking and cycling are also crucially important in allowing people to reach public transit facilities, but little attention is generally paid to these access modes.

Investments in walking and cycling facilities are investments for the poor. This creates a new society where people of all incomes can meet as equals on a bike path or a sidewalk. In the developing world where income disparities are often very high, this potential role of non-motorised transport is very important. In Bogotá the safest place in the city is the Ciclovia. On Sundays 120 kilometres of main arteries are closed to traffic allowing about 2 million people to cycle, rollerblade or just jog and walk. It is a meeting place were the highest income earners ride beside the lowest earners. Carfree Development is getting more and more momentum. For this reason GTZ decided to issue a dedicated module on Carfree Development (within the Sourcebook series of Sustainable Urban Transport), which will be available from July 2005.

1.5. Increasing safety and health

Promoting safe bicycling and walking is vital to reducing over 500,000 premature deaths from traffic accidents each year

There are an estimated 1.1 million traffic deaths globally each year, and among young people in developing countries traffic accidents are the second leading cause of death according to the World Health Organisation. In developing countries, the vast majority of the victims of traffic accidents are pedestrians and cyclists, though with increasing motorcycle use, motorcyclists are fast becoming the majority of highway fatalities in higher income Asian countries. Having a father or mother killed or disabled in a motor vehicle accident, horrible in itself, will almost certainly throw a lower middle class family into destitution.

In 1997 Bogotá had a traffic death rate of 2 to 3 people every day, which is one of the highest in Latin America. Even though it is still very high it has dropped to 1 to 2, due largely to dramatic improvements of public space and in cycling and walking facilities.

Bicycling and walking provides important aerobic exercise which is important to combating high cholesterol, obesity, diabetes, and depression.

Increasing evidence, according to the US Centre for Disease Control, indicates that the global epidemic of obesity, high cholesterol, diabetes, and depression are directly linked not only to diet but also to the sharp decrease in average daily aerobic exercise. Bicycling and walking can help address these issues. For people without daily exercise, cycling of 30 minutes per day would reduce their risk on vascular disease and diabetes by 50%.

Ciclovia: Car-free Sunday in Bogotá
Institute for Sports and Recreation,City of Bogotá

Bogotá Car Free Day: a bicycle tour headed by the mayor Karl Fjellstrom, 2002

Benefits of planning for cycling

Contributed by Roelof Wittink, I-ce, and based on the chapter: "Planning for cycling support road safety", in the book: "Creating Sustainable Transport", ed. Rodney Tolley, Woodhead Publishing Ltd. UK, 2003

Safety-related benefits

Data from different countries shows that an increase in cycling use and an increase in the safety of cycling can go together very well. The Dutch Bicycle Masterplan[1] concludes that in 1998 the number of fatalities among cyclists was 54% lower than in 1980 in spite of the increase in both car use and bicycle use. The increase of car kilometres was about 30% over the same period. In Germany the total number of cyclist fatalities fell by 66% between 1975 and 1998 while the share of cycling in transport increased substantially, from about 8% to 12% of all trips.[2] In the city of York in the United Kingdom 15 cyclists were killed or seriously injured from 1996 – 1998 compared to 38 in 1991 – 1993, while cycling levels rose from 15 to 18% of trips.[3]

Mini roundabouts lower speed and facilitate safe integration between cars and cyclists (Utrecht, The Netherlands). Roelof Wittink, I-ce

The best explanation for these effects is the integration of cycling – and of walking – in our traffic and transport systems. A good mix of motorised and non-motorised modes of transport brings the traffic system onto a more human scale. This required a change in the planning and the design of the roads. The measures also have a huge positive impact on the motorised modes.

This approach fits very well with the modern road safety approaches that aim to minimise the risk of serious accidents, such as the Dutch concept of Sustainable Safe Traffic and the Swedish 'zero road fatality vision' concept. A key element in these modern approaches is the prevention of risk by giving due consideration to the limited abilities of human beings, meaning that conflicts between road users with huge differences in mass and speed should be made technically impossible. The traffic environment should enable all road users – with their huge differences in skills and experiences – to behave predictably and

Separate bus and bicycle lanes through an intersection in Utrecht, The Netherlands. Roelof Wittink, I-ce

Segregated bicycle tracks in Bogotá, Colombia Roelof Wittink, I-ce

respectfully to each other. The consequences for the road network are a categorisation that accommodates the efficient flow of all different modes to a certain extent and protects our urban areas from domination by motorised traffic. The vast majority of the whole road network has a low speed limit and is adapted to facilitate cycling and walking in a safe way.

This policy provides the right conditions for safe cycling. It may not be primarily the cycling facilities to segregate cycling from other modes on the road that will increase the safety of cycling, but the integration of cycling in the overall design. By catering for a safe mix of modes, cycling can even become a catalyst for a very successful road safety policy.

1. The Dutch Bicycle Master Plan, description and evaluation in an historical context, Min. of Transport, 1999.

2. Pucher, J. (1997), "Bicycle Boom in Germany: A Revival Engineered by Public Policy" in: 'Transportation Quarterly 51 (4) and
Pucher J. (2001), "The role of public policies in promoting the safety, convenience & popularity of bicycling", in 'World Transport Policy & Practice, Volume 7, (4), 2001.

3. Harrison, J.: "Planning for more cycling: The York experience bucks the trend", in 'World Transport Policy & Practice, Volume 7, (4), 2001.

An advanced stop line for cyclists makes them more visible and provides them with right of way (Utrecht, The Netherlands)

Roelof Wittink. I-ce

This phenomenon is also evident in developing cities, where poor conditions for pedestrians result in motor vehicle use for even short trips. Health problems associated with lack of aerobic exercise are not limited to rich cities.

1.6. Review questions

Non-motorised transport not only leads to reduced pollution emissions, but also provides a wide variety of other. Using examples from cities in your region, discuss in groups and elaborate answers to the following question:

- How can non-motorised transport facilitate sustainable development in urban transport?

2. Social marketing and economic relevance of cycling

This chapter is a contribution by Roelof Wittink, Managing Director I-ce Interface for Cycling Expertise

2.1. Social marketing and demand orientation

The social or societal notion of marketing is based on the idea that the benefits and costs of alternative means for production and consumption should also be pursued from a societal perspective. Thus, local and national governments may want to promote cycling as a more attractive alternative means of transportation than, say, driving a car. Consumers will of course differ in how they make tradeoffs between options that vary on multiple dimensions such as speed, safety, health, and environmental impact. Suffice it to say that cycling is becoming an increasingly important policy issue. This is true all over the world, although the characteristics of alternative means of transportation and the stakes of various constituencies differ between countries. Due to such differences, the measures used will differ as well.

Still, we contend that it is the share of cycling in traffic and transport that determines to what extent investments in the promotion of specific alternatives such as cycling can have a positive societal impact and show sufficient return.

From marketing we learn that a demand orientation is the key to sell a product. In social marketing, a social interest is at stake, but the demand orientation is equally important.

For the marketing of cycling, the questions need to be addressed:

- What are the target markets to promote cycling?
- Which consumers are most sensitive to a message that emphasizes, say, the positive contribution of cycling for society?
- What types of bicycles do targeted market members prefer?
- What is the optimal segmentation for bicycle products and messages to promote cycling?
- What are the best messages to communicate cycling integrated in the social interest?
- Which public and private actors can we involve to help develop and implement the right mix of actions?
- How do we show the impact of these actions so that we can help sustain cycling policies with a positive impact on societal well-being?

2.2. Agenda setting of cycling

Several policy subjects have recently resulted in agenda setting of cycling. Each subject addresses:

1. The importance of the social interest
2. The contribution that cycling provides towards improving this social interest
3. The specific (added) value of cycling relative to alternatives that can serve this social interest
4. The target group (segment) within the population of road users for which the social interest is most relevant.

These four components provide the basis for setting targets for cycling promotion from the perspective of public or private organisations. We can also use social marketing to identify the scope of the promotion of cycling. So for each topic we have to find out:

5. The (potential) demand for cycling by the selected target group of road users, and the obstacles that prevent them from currently using the bicycle
6. Given the potential for cycling promotion, identify the cycling product that matches the demand of the target group to eliminate at least some obstacles to cycling use
7. The product specifications for the different public and private organisations to address the potential demand
8. An approach for an integrated promotion effort by the relevant public and private organisations.

In the Annex you will find four contributions to this theme.

- **Annex 1:**
  Francesca Racioppi, World Health Organisation, presents cycling from the perspective of health promotion.
- **Annex 2:**
  Enrique Peñalosa, former mayor of Bogotá, presents the case of cycling with respect to democracy.
- **Annex 3:**
  Andrew Wheeldon, Bicycling Empowerment Network Cape Town, presents cycling from the perspective of poverty alleviation.
- **Annex 4:**
  Hugo van der Steenhoven, Fietsersbond, the Dutch Cyclists Union, presents a partnership with employers to promote cycling.

2.3. Expanding the role of the urban NMT sector for job creation

The example from the Boda-Boda business in East Africa (Uganda, Kenya, Tanzania and Ruanda) shows that non-motorised bicycle but also low-powered motorcycle taxis are an important source of employment for the poor. Many young urban men find work as Boda-Boda operators. Though they play an increasing role in urban low capacity public transport and - as transport service for numerous types of goods - also within the urban economy, they face a very low image. Secondly and the most serious problem is the ever present danger of accidents with motorised vehicles.
As a local industry, its labour absorption capacity should be recognised and encouraged:

- Giving the driver a formal recognition of the local authorities
- Providing assurances for drivers
- Credits for bicycle purchase
- Involvement of local manufacturers in design and production of specific equipment (carriers, footresters etc.)
- Quality repair facilities
- Control of number of Boda-Boda (if taxi-density and competition becomes to high)
- Improving image and consistency among drivers: Establishing an umbrella association (Driver's Association)
- Introducing/testing new vehicles (e.g. tricycles)

The introduction and – in a later phase - the in country production of new vehicles like cycle-rikshaws or improved bicycle technology (e.g. the image improving, ITDP made California Bike) on the urban market can create jobs in the manufacturing business directly and indirectly by increased use of NMVs. Steps to be taken are:

- Define the objectives/targets of the new vehicle introduction (safety, image, affordability, technology, mobility for disabled etc.)
- Identify areas, manufacturers, shops for a test phase
- Analyse traders' opinion (on price, technology, purchase/whole-selling: loaning/credits)

Seamless modal integration: A cycle parking facility at a TransMilenio station in Bogotá

Shreya Gadepalli

- Find out rival products on local/regional market
- Estimate demand
- Get feedback from user perspective/test-persons (objectives see above)

Decide on necessity and way of vehicle promotion (e.g. get a champion)

2.4. Increase affordability of NMVs and use of NMVs for urban population

In brief, there are 6 options to be tested to increase urban use of NMV by the poorer part of the population:

- Incentives to employers to establish bicycle credit or saving schemes (e.g. factory saving societies for factory employees)
- Incentives for bicycle/NMV sale-on-credit schemes by dealers (difficult !)
- Incentives for bicycle lease contracts by bicycle hirers (depending on financial position of hirers to pre-finance vehicles)
- Promotional sales of bicycles/NMVs to women or students (by welfare organisations)
- Import tax or VAT reduction (high price elasticity of NMVs)

A support program to NMV/Bicycle hire operators to hire out lady bicycles (lady bicycles are found to attract more women as clients and also men like them for improved riding convenience).

3. Non-motorised vehicles

3.1. Improving non-motorised vehicle technology

This chapter has been adopted from "Non-motorised Transport in African Cities" by Walter Hook & Jürgen Heyen-Perschon

For many years transport experts comparing Africa and Asia have noticed that the vehicle mix in Asia is far more diverse for both motorised and non-motorised vehicles, giving Asians a greater diversity of trade offs between speed, comfort, load capacity, and cost of different vehicle types. Many types of non-motorised vehicles that are ubiquitous in Asia are rarely found in Africa, such as cycle rickshaws. Asia and Africa share a common problem that those non-motorised vehicles that do exist, namely standard bicycles and various forms of work cycles, tend to be of low quality and outmoded design.

Normal bicycles in Africa have been heavily dominated for years by the traditional black English roadster, for a while made partially in Africa, but today made almost entirely in India or China. Only recently has a market developed for mountain bicycles. Neither type of bicycles is really ideal for African utilitarian cycling, as the mountain bikes being imported are of poor quality and insufficiently robust for utilitarian or work use, while the old English roadster with its large wheels and frame and narrow tires is not designed for operating on dirt tracks or on roads in very poor condition.

The work cycles, vendors carts and other non-motorised vehicles used in Africa today haven't changed for decades or – in case of animal drawn carts – for centuries. As a result, these vehicles tend to be needlessly heavy, slow, and of poor ergonomic design. They do tend to be fairly robust, however, resistant to damage and easy to repair.

The non-motorised vehicle industry in Africa tends to be dominated by small scale, traditional family-run businesses. Because they require low-capital investment to enter the business, they are low profit margin industries. As such, they are extremely risk-averse and have little money to invest in marketing, promotion, technological innovation, or even in testing new products commercially available elsewhere for which a domestic market is not yet proven.

Development institution-led efforts to date to induce the development of a steady commercial supply and demand for intermediate non-motorised transport vehicles into Africa have only had modest success thus far. However, the increased effort gives source for optimism. There are ongoing efforts to introduce better utilitarian bicycles, but they are still in their early stages. There have been several cases of a small number of Asian cycle rickshaws being imported into various African cities (in Kenya and Ghana), but none of these efforts became ongoing commercial ventures.

For freight vehicles, in the most successful case, one private manufacturer continues commercial sale of some 25-30 bicycle trailers per year. Many of the vehicles themselves, most made under the auspices of World Bank and DFID-funded intiatives in Ghana, or ITDP initiatives in South Africa, have largely been idled by lack an institutional framework to provide ongoing maintenance, lack of tools, repair skills, and spare parts.

Delhi rickshaws seized by police for operating in areas where they are banned. A cycle rickshaw modernisation program has helped increase support for the vehicles accross India.
Walter Hook, ITDP

The main causes of this limited project success are as follows:

- The level of program funds was low.
- The focus of the project on reducing rural poverty led to the mistaken impression that the private sector actors involved should necessarily be entrepreneurs from the locality of the intended beneficiary. As a result, the private sector participants involved were quite small with an extremely modest market area, and limited capital.
- The product design or specification process was done largely in isolation from international, national, and local suppliers of NMVs.
- Development agency support should have focused as much attention on underwriting the costs of promoting the new technology and developing a market for it as went into the vehicle design process.

3.2. ITDP's improved Rickhaw-Technology Project in India

A recent ITDP project to improvement of the traditional Indian cycle rickshaw was the first project of its kind to bring about commercial adoption of better cycle rickshaw designs in India. For over 20 years, engineers in India had worked on superior cycle rickshaw designs, but none of them were ever commercially adopted. The reasons were mainly that these efforts were based primarily out of universities and research institutes with little connection to the actual cycle rickshaw industry. The designs themselves were not grounded in commercial reality, and the projects only focused on design without supporting the marketing and promotion also critical to commercial adoption. In 1997, ITDP and the Indian Institute of Technology put together a team of US and Indian human-powered vehicle designers. Working directly with the cycle rickshaw manufacturers as partners, they developed and commercially tested over 20 new designs, one of which proved to be commercially accepted. This design was 25kg lighter, had two speeds, a strong integral frame, and a much more comfortable passenger seat and permanent canopy.

Ultimately, the new design won commercial acceptance because ITDP spent over $25,000 into public relations, advertising and promotional events with the potential buyers and political leaders. The commercial viability was based on the fact that customers preferred the new designs because they were more comfortable, while the vehicle itself cost less to manufacture than the original vehicle. The project also worked directly with local financiers and fleet owners, rather than trying to circumvent them for social reasons. Ultimately, slightly heavier (only 10-15kg ligher than the original) one-speed retrofit (which allows the cycle rickshaw owner to retain the original bicycle front-end of his own vehicle, while providing the more comfortable seat) came to predominate commercially in Delhi. In Agra and Vrindavan, a one-speed version of the project's original model remains predominant. To date, over 12,000 of these modernized cycle rickshaws have been manufactured and sold, and they are highly visible particularly in Vrindavan (where the entire fleet has been replaced), certain neighborhoods of Delhi, and in the Taj Ganj and Dayal Bagh neighborhoods of Agra.

Indian Cycle Rickshaw Modernisation Project

Another innovative way of increasing the use of non-motorised transport is to work with the human powered vehicle industry to modernise non-motorised vehicle technologies.

While the bicycle is constantly being modernised by a dynamic and competitive industry, in many Asian countries bicycle rickshaws continue to be manufactured based on outmoded design developed in the 1950s. As a result, they are extremely heavy, slow, and uncomfortable, weighing around 80kg. Their outmoded designs make life hard for the low income operators. This has made it possible for politicians to ban the vehicles on supposedly humanitarian grounds. Unfortunately, banning the vehicles only takes away a valuable job from a low income person, and forces people to walk long distances or use more expensive and polluting motorised vehicles.

An innovative project sponsored by USAID and carried out by the Institute for Transport and Development Policy succeeded in modernising the Indian bicycle rickshaw. There was never any shortage of alternative designs, but until the recent project none of them had ever been commercially adopted. As a result of the project, today there are more than 10,000 much lighter (55kg) and more comfortable bicycle rickshaws operating on the streets of Delhi, Agra, and a half dozen other Indian cities. These vehicles actually cost less to manufacture than the traditional cycle rickshaws. Operators of the new vehicle saw their incomes increase from 20% to 50%. Surveys also indicate that around 20% of the passengers of the new vehicles would otherwise have taken a polluting motorised vehicle.

The entire fleet of over 1000 cycle rickshaws in the city of Vrindavan, India, has been modernised. Walter Hook, ITDP

Successful commercial adoption of a better cycle rickshaw required not only the development of a superior design, but also an extensive marketing push and the entrance into the market by at least one corporate entity willing to compete to capture the traditional bicycle rickshaw market, forcing the traditional industry to respond.

The project has been replicated with support from GTZ's GATE program in Yogyakarta, Indonesia. For more information, please see Annex 5 about the project.

The first modern cycle rickshaws in India were sold to the drivers operating across the street from the Sheraton in Agra, India. Walter Hook, ITDP

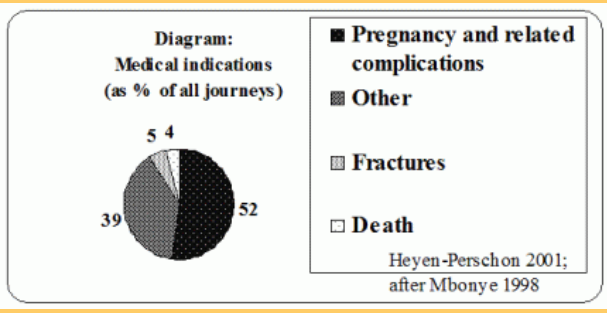
GTZ/FABIO Vehicle Redesign Efforts in Uganda

In 2000 FABIO (First African Bicycle Information Office/Jinja/Uganda) has carried out a redesigning and re-enforcing of bicycles and carts to suit the needs of the urban poor and to ensure the durability of the vehicle. One of such items was a manual cart that was designed and assembled for women who are involved in selling fruits and other small items of domestic use for a living. The ladies' sales have shot up and some are now thinking of expanding the business by hiring a second person to run a second cart. However, there are currently only 2 carts.

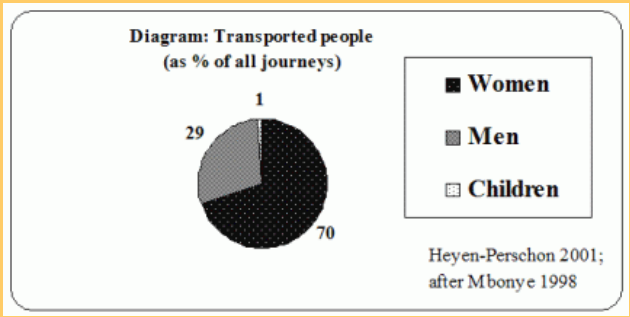
During the period between Jan. and Dec. 2001, 100 ambulance-trailers were assembled by the BSPW for the FABIO Bicycle Ambulance Project. The bicycles in combination with their specially built trailers, financed through donations were distributed in Kabale, Bugiri and Soroti District has recorded good results. Its only limitation is the high costs of production of the bicycle ambulances. Since that time, Roadmaster Uganda has gone into production of these vehicles and started trying to market these to ministry of health officials.

Though no statistical figures were raised, the bicycle ambulance project contributes to the reduction of infant and maternal mortality in periurban and rural Uganda. It provides the only affordable and appropriate transport – system for patients of low income households.

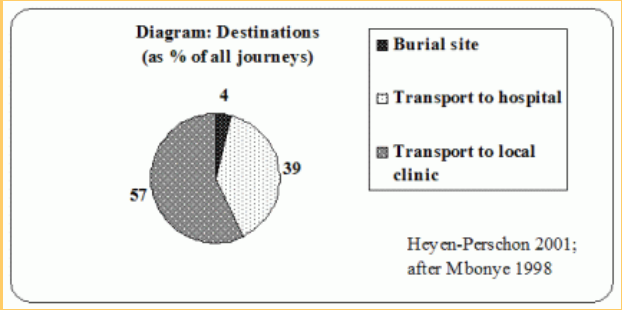
The results of some of the monitored ambulances show that the new transport facility was rapidly accepted and used, depending on the number and type of medical emergencies. During the period of the survey (one year), the frequency of use varied between 23 and 32 occasions. One typical use was the transport of pregnant women, which accounted for 52% of all medical indications for transport (see diagram on the right).



For this reason, women accounted for the largest proportion (70%) of peoples transported, followed by men at 29%. It was surprising how rarely children were transported (1%). It is relatively straightforward, though, to transport the latter on a bicycle without a trailer (see diagram below).



The most frequent destination, at 57%, was the local clinic. As many as 4 in 100 journeys involved transport to a burial site (see diagram below).



After one year, the groups had incurred average costs of USh. 14.200,-. If an amount is added for depreciation over the course of five years (price new 250.000,-), the total monthly costs come to USh. 4,400,-. Assuming a monthly payment of USh. 300,- per group member, even as few as 15 members are sufficient to run a bicycle ambulance efficiently.

Ultimately, however, for this vehicle to be successfully commercialised, a health ministry or major NGO would need to incorporate their leasing into their annual budgets. Discussions have been held with the Ministry of Health to have this project integrated in that of the Ministry but it seems the government still has the traditional ideology that a bicycle is a sign of backwardness, therefore they seem to be so reluctant.

4. Involving stakeholders and NMT related NGO's

4.1. User Participation

User participation has to be at the centre of the implementation process. Users should be involved in all aspects of NMT Projects. Possible ways to do this are:

- Focus Group Discussions to identify the problems and make an inventory of these challenges;
- General User Platforms articulate and prioritise the user needs;
- Local User Platforms actively involve in the planning and implementation of NMT interventions; and
- User Associations to take a major role in the maintenance and operations of the built NMT infrastructure.

In the SSATP projects, for example, there were several challenges in making user participation effective:

- Heterogeneity of the community made it difficult to sustain the users' interests in projects, unless there was a common problem and mutual trust;
- Historically set attitudes, regarding the fact that these were traditional government responsibilities, created reluctance by the users to participate;
- Continuity of participation was difficult to achieve; and
- Allowances paid to the participants created difficulties for assessing the motives for participation and continuity. However, when the practice of paying allowances stopped completely, there appeared to be better participation.

The lessons learned with user participation in SSATP were:

- **Lesson #14:** *Effective user participation is central to community empowerment and to the continuity of positive policies towards NMT users. If not properly structured, UP can be costly, cumbersome and frustrating. When structuring UP, it is important to strive for a balance between complete citizen controls of the projects on the one hand and total professional control on the other.*
- **Lesson #15**: *Effective UP requires fully trained professional staffs who are sensitized to the importance of UP and truly believe that UP can make an effective contribution to the project interventions at all levels.*
- **Lesson #16:** *Large-scale public awareness campaigns are costly and have limited impacts without a proper follow up. The best approach is targeted awareness campaigns combined with NMT interventions, over the long term.*

4.2. What is a Bicycle User Group?

Adapted from Transport Bikewest and the Bicycle Transportation Alliance, Bicycle User Group Manual, 1998

A Bicycle User Group or BUG is an organisation set up by cyclists whose aim it is to improve cycling conditions in their local area. BUGs are usually made up of local cyclists who enjoy bicycle riding for transport or for recreation purposes. Different members will bring different skills to the group; they may be professionals, students, officials, or others, united in a common desire to promote cycling.

BUGs vary in size and purpose. They may meet on a regular basis to work out strategies to improve cycling in their community, in their building, or on their university campus. Some organise Bike to Work days or other activities with work colleagues. BUGs also are involved in transport planning and work for beneficial physical changes as well as policy changes.

The role of a BUG

BUGs encourage local government to provide better facilities and safer routes for commuter cyclists, for children riding to school and for recreational cyclists. It is common for BUGs to provide detailed recommendations to the city government on how to improve facilities, and to be involved with implementing measures. An excellent example of an active BUG is the Urban Cyclists' Association (ACU) of Buenos Aires, which has conducted rallies, seminars, forums and special events, carries out three weekly social rides (two in the evening during the week, another every Sunday), issues a newsletter and a bicycle manual, makes presentations at schools, conducts studies on issues such as bicycle parking and integration with commuter rail, and provides detailed recommendations to the municipal government; all based on membership fees and occasional fund-raising events or paid tasks, and with virtually no outside funding support. Since the economic crisis in Argentina, ACU promotes cycling not as 'recreational' or 'green', but as a way of reducing the transport burden on the urban poor. The major emphasis of a city-level BUG is to focus bicycle advocacy at a local level and to bring the discussion down to detailed proposals. In this context however the roles of BUGs are many and varied. They are able to:

Doing the government's work for them

Government officials may be particularly appreciative if the BUG can do their work for them, by submitting detailed and feasible proposals based on surveys and 'rapid assessment' studies conducted by the BUG.

- provide a forum for cyclists to meet, discuss local bicycle issues, and hold social events
- work with the city government to improve cycling conditions
- assist others (neighbours, friends, work colleagues, campus friends) to start cycling.
- arrange and participate in social rides in their city, local festivals and community events (see Tour of the Fireflies).

What BUGs can do

There are many activities that BUGs get involved in, all of which contribute to a better cycling environment. BUGs can:

- Advocate the adoption of a local bicycle plan. Bicycle plans are still rare in developing cities.
- Provide input to councils, businesses and institutions to determine appropriate locations (and type) of bicycle parking facilities by undertaking bike rider surveys.
- Help to change attitudes towards cycling, eg. by talking with local government officials.
- Request better end-of-trip facilities in business and work places (eg. parking, lockers, showers).
- Advocate the creation of bike lanes.
- Advocate increased accessibility for cyclists to trains and buses and secure parking facilities at bus and train stations.
- Encourage bicycle education in schools, and assist schools to conduct cycling awareness and education events.
- Write to magazines and newspapers, and possibly develop their own newsletter.
- Establish a Website.
- Attend public bicycle exhibitions and special events and set up display boards.
- Organise regular rides and informal social functions for members and the public. The ACU in Buenos Aires for example has a Children's Ride once each month in addition to the regular weekly rides.
- Invite councillors and officials to meetings.
- Establish contacts with local bike shops. There are good places to leave promotional material to generate membership.

Manila's Tour of the Fireflies

"MoBiLeS: More Bikes Less Smog" Report
Excerpt from full report posted to the CAI-Asia discussion list

Earth Day Eve, April 21, 2002: The Firefly Brigade's annual activity held on this day was the Tour of the Fireflies that seeks to heighten awareness of the dismal air condition in the metropolis. A 50-km tour of seven municipalities in Metro Manila, this year's edition started at the University of the Philippines at Quezon City.

In terms of participation, this year's tour is the biggest since it started in 1999. There were around 700 registered riders, and a total of 1400 – 2100 riders overall; a figure consistent with media and police estimates. This can be attributed to an unprecedented media blitz in print and television through partnerships with The Philippine Daily Inquirer and Bantay Kalikasan. Other sponsors that helped in disseminating information and registration are Cravings, Bisikleta Atbp, Bi-cycle Works, Joven Bicycle Shop, The Bike Room, Roosevelt Bicycle Center and Extreme Bike Shop. At intersections the mass of riders blocked traffic for an average 30 minutes. Needless to say, this spectacle had people pouring out of their homes.

The Tour passed through a representative sample of Metro Manila's streets. Smooth multi-lane concrete highways served as a counterpoint to narrow, labyrinthine, pot-holed side streets. This experience opens participants' minds to the need to maintain these roads, use quality materials in the first place, and encourage bicycles to lessen the volume of traffic which rips up the roads. The knowledge of alternate routes was also presented.

"I can't believe I'm here in Manila, all the way from UP!", an excited participant declared at Quirino Grandstand, the Tour's halfway point. His previous longest ride was but a few kilometres pedaled at the car-less oval in UP on Sundays. Yet there he was, 25 kilometers already ridden, pumped up and ready to tackle the rest of the route. Suddenly biking to work didn't seem a strange and remote concept; it was within reach.

The deliberate pace of the Tour is geared towards that of maintaining a comfortable speed within the abilities of the beginner cyclist. Even children had a grand time. At an average of 17 km/hr, almost everyone can keep up with the pack. With this partnership, beginners are launched into the world of cycling as their enthusiasm and confidence are heightened. Now, numerous beginner cyclists, some of whom had never ridden beyond 5 kilometres early in the year, join the weekly Firefly Brigade rides which typically run for at least 40 km per ride. The tribe is increasing.

This year's Tour has seen the emergence of an organized Marshal group. A total of 45 Tour Marshals have trained for weeks prior to the Tour. They have been divided into 4 groups with specialized duties. There are marshals that clear the way, pace the group, protect the team at the periphery, and sweep the lagging riders. Backing up the marshals was a team of two ambulances (Fire Protection & Emergency Assistance Group) and several support vehicles, courtesy of the Tour sponsors (the main support vehicle was provided by Bicycle Works) and private individuals. A much needed water station was established by Uniglobe/Camelbak at the halfway and end points of the Tour. They also provided the orange vests that identified the marshals.

The Tour of the Fireflies ended at Marikina Riverbanks with a flourish. There was an epidemic of high fives, hugs, handshakes, smiles and welcome kisses as friends who got separated during the ride finally met up. The most heard question was "Why does this happen only once a year?" At the ensuing program, awards provided by the Tour sponsors were given to deserving riders. Though sapped by the effort and intense heat of the summer sun, many of the riders, empowered by the experience, were already looking forward to the next Tour of the Fireflies, which promises to be even bigger.

More information on the Firefly Brigade:
http://www.fireflybrigade.org/

4.3. Forming and maintaining a Bicycle User Group

The key to successful advocacy is organisation. The combined voices of a number of people is more effective than individuals labouring by themselves. Working with others to achieve a common goal is also more enjoyable and rewarding.

There are many ways to contact local cyclists and others who may become members. BUG members may phone, write a letter, make a personal visit or even reach out to potential members via newspaper advertisements, internal bulletins or newsletters, and radio talk shows.

Composing a leaflet or flyer is a good way to get the message out. It should include details such as the purpose of the BUG, background information about the importance of cycling for a sustainable transport system, particular cycling improvements which are needed, main activities, membership processes, meeting times and locations, and full contact details (Figure 5).

Forming a strategy for the BUG launch

Careful planning is needed to ensure initial involvement and ongoing support. A formula that has been successful for other BUGs has been:

- a small initial meeting with key supporters
- a public meeting with many members of the community attending
- a 'follow-up' meeting with interested attendees from the 'core' group and the public meeting
- ongoing BUG meetings.

The initial meeting - the 'core' group

The first meeting to set up the BUG would be small, with only a handful of known advocates. Prior contact should be made with known cycling advocates. Send out material and follow up with a phone call asking for local concerns and issues and inviting them to the meeting. Send out the meeting agenda prior to the meeting.

The public meeting

The second meeting would be much larger, a public meeting, where advertising is done to attract as many interested cyclists as possible. Members of the core group can spread the word about the upcoming public meeting. (see below "Getting People to the Public Meeting"). The purpose of the public meeting is to draw in other interested cyclists and find out what the local issues are. A public meeting will give the BUG more credibility when negotiating with the local council and other authorities.

The follow-up meeting

The third meeting would be the first 'real' meeting of the BUG, which involves those who attended the original ('core group') meeting, plus others who are attracted to the BUG as a result of the public meeting.

The regular BUG meetings will concentrate on prioritising the issues raised by the community, working out strategies for getting things done, sharing success stories, planning

Fig. 5: A Buenos Aires Urban Cyclist Association member places a leaflet on a car parked in a bike lane, pointing out that parking is prohibited. The back of the leaflet contains basic information and contact details for the Association.

Karl Fjellstrom, Mar. 2002

rides, or other activities to keep members interested and active.

Getting people to the public meeting

- Prepare a flyer for widespread distribution.
- People from the initial 'core' group meeting can hand flyers to cyclists when they meet them at shopping centres, riding along roads, at leisure centres, libraries and on campus. Stapling or taping a flyer on parked bikes is a very effective method of reaching cyclists.
- Prepare enlargements of the flyer for display at local bike shops, notice boards of the local community & recreation centres, supermarkets, university and school noticeboards, and places of worship.
- Speak to the owners/staff of local bike shops, as they may help set up the BUG, or at least become a member. They may have a mailing list of customers which they could provide.
- Notify principals of schools in the area.
- Insert notice in "community events" column of city newspapers.
- Make arrangements for a photo/story in local newspaper (provide Press Release and suitable photo(s) to journalist).
- Insert notice in school and campus newsletters.
- Spread information by word of mouth - neighbours, friends, relatives.

Meeting agenda, contact details, and delegation of tasks

At each of the meetings of the BUG be sure to get the names and contact details of people attending. A meeting agenda is important, with a list of items to be covered. Discussion should be kept tight and to the point.

It may also be useful to rotate responsibility for facilitator, note-taker, and time-keeper of each meeting.

It is important to share the workload. Each person should walk away from the meeting with a task to complete by the next meeting. The group will then feel a sense of involvement.

4.4. Liaising with city government

City governments and cycling

City and local governments in developing cities are responsible for traffic management and wider transport planning, and they have a major influence over the provision and maintenance of bicycle facilities in the city. It is very important that the BUG familiarise itself with the many different agencies (Transport, Parks & Gardens, Public Works, City Planning, Environment, Health, Tourism), and their areas of responsibility. It is important that the BUG develop contacts and working relationships with officials in these agencies (Figure 6).

When liaising with the city government and also the city council, the BUG should aim for:

- Policy commitment - a commitment to 'think bike' in transport planning can improve conditions at no extra cost.
- Recognition - that cycling is a major part of

Fig. 6: Members of the Buenos Aires Urban Cyclist Association discuss strategy at a regular meeting. The Association maintains close relations with the Public Works & Services Office, where the head of the Association works. This relationship has helped them achieve implementation of several measures to improve conditions for cyclists in Buenos Aires.

Karl Fjellstrom, Mar. 2002

the solution to problems caused by too many cars, not just an added extra.

- Planning - to have cycling clearly supported and provided for in city planning schemes, plans, subdivisions and developments.
- Participation - regular meetings with officers, interested councillors and other groups to maintain communication and to hold discussions in a 'round table' setting.
- Cycle counts - surveys establishing the real rate of cycle use and demand in the area.
- Cycling Officer - the appointment of a cycling officer as a point of contact and responsibility can be very useful.
- Budget - a commitment to spending on cycling schemes is crucial.
- Targets - getting the council to publicly set a target for increased cycle use (by a given date). This makes a good publicity opportunity and allows the BUG to push for further facilities and spending.
- Bicycle parking - at schools, markets and shopping areas, and places of worship. Bike parking is quick to install, cheap, symbolic and important in encouraging bicycle use.
- Public commitments - ultimately work to get public commitments from councils – a small promise made public is as important as private hints of larger concessions which never materialise.

Liaison with city councillors

City councillors value public opinion. The most useful councillor is one who cycles and understands that cycling has a role to play in serving the local community and environment. Some tips for communicating with councillors:

- Inform them - put them on the BUG's mailing list, invite them to public meetings.
- Write to them outlining the case for cycling and the BUG's objectives for promoting it.
- Ask for their support and/or comments. Letters (not identical) from different people can indicate a wider level of public concern.
- Invite them to take part in special events and photo opportunities (Figures 7 and 8).
- Most councillors are extremely busy, so information for them should be concise.
- Brief them regularly and accurately; establish the BUG as a reliable source of information.
- Be prepared to explain the issues and tackle misconceptions. Some councillors will have an interest in cycling and may argue the case before Council and committee meetings.

A case study from Sao Paulo illustrates the

Fig. 7: Mayor Antanus Mockus of Bogotá (right) promotes bicycling in February 2002 on one of Bogotá's new cycle routes. This kind of activity also brings the mayor into closer contact with citizens. Karl Fjellstrom, Feb. 2002

Fig. 8: The Head of the Surabaya City Council and leading officials take part in a Car Free Day held in Surabaya on 30 May 2002. Karl Fjellstrom, May 2002

potential achievements when experienced cyclists combine with municipal officials to promote a bicycle plan.

4.5. Involving the public

Involving the general public is important for the BUG, and might include:

- hosting events such as a "bike to work breakfast"
- volunteering to provide secure bike parking at an event
- bicycle maintenance clinics
- displays at shopping malls, and local markets and campuses
- letters to the editor
- surveys and small studies
- partnering with the private sector
- networking with other organisations. Transit advocacy groups could for example be considered natural allies of a BUG.

4.6. Expanding the focus and capacities of User Groups

NGOs, working to expand the role of NMT and trying to influence or change municipal and national transport policies, should not only concentrate on cycling but on the whole spectra of intermediate means of transport, including animal traction modes and walking. It would more be a Urban Mobility Group, focussing low cost mobility options. In this it is necessary to strengthen these NGOs in:

- State of the art knowledge on low cost means of transport and its optimum use and position in the "urban transport chain"
- To prepare and implement programmes for advocacy (convincing decision makers) and education for creating awareness on the importance and benefits of fostering access to affordable transportation for economic advancement and poverty alleviation
- To collaborate with other agencies working in the sector (Knowledge Sharing)
- To support any future activity that aims at integrating marginalized groups
- To increase organisational skills in order to plan, implement but also monitor pilot projects - basing on a participatory approach.

Ciclo Rede: Raising awareness about cycling in Sao Paulo

Source: Andreas Marker, Andreas Nieters, Projeto ProGAU - Gestão Ambiental Urbana, 2002

The "Ciclo Rede" project is a recent initiative of the São Paulo Municipality together with GTZ to promote the use of bicycles as an alternative mode of transport in the São Paulo City area.
Research has shown that in this city of 10 million inhabitants, nearly 10 million short distance trips are made daily by pedestrians, indicating potential for the use of bicycles.

Methodological approach

The "Ciclo Rede" guide contains a map of bicycle routes forming a network in an area of about 40 square kilometres in the north-western part of the city.
The routes are traced essentially on secondary roads and are mapped according to the following criteria:

- Relatively less car traffic compared to other roads,
- Abundance of trees and shade protection from the sun,
- Scenic routes,
- Small or no inclination,
- Most direct, straight connections between main urban points such as public institutions, commercial and cultural centres, and parks.

The map guide, of which 40,000 copies were distributed, contains safety hints and tips for urban bikers, such as addresses of bike shops and cyclist NGOs.
The strong point of this initiative is the fact that it was implemented by experienced "urban bikers", in cooperation with the municipal Secretary of the Environment. Thus it represents a realistic conception of the possibilities of bicycle use in São Paulo, supported by several NGOs. Upon publication it received considerable attention by the local media and residents.
GTZ provided impetus for the idea, and financed mapping the routes by contracting experienced bikers. The editing, publication and distribution of the guide, and promotional events, were sponsored by private companies together with the municipality.
As a follow-up measure, a new "Ciclo Rede" was introduced by the municipality in the historic center of São Paulo, giving continuation to the initiative.

A detail from the map.

Implementation

Although some steps towards sustainability have been taken, "Ciclo Rede" is presently not officially supported by the local government (City Secretary of Transport). Without adequate signposting and construction of special bike routes in crucial stretches of the network, it lacks attractiveness for the "newcomer" or casual biker and will be restricted to a rather small and experienced group of "professional bikers".
Other municipalities have shown interest in adapting the concept, suggesting that the goal of creating more awareness of urban transport and environmental issues has been achieved by "Ciclo Rede".

5. Regulation of non-motorised vehicles, their operation and use

5.1. Regulation of non-motorised vehicles and their importation

Motor vehicles are regulated for several reasons. If a motor vehicle is not well maintained, or does not have proper lights, it will pollute the environment and endanger others. As bicycles, cycle rickshaws, and other NMVs generate no pollution, and operate at slow speeds, a mechanical failure is very unlikely to endanger others. As such, many countries do not require NMVs themselves to be regulated, and where regulations exist enforcement tends to be lax.

For motor vehicles, governments regulate the types of vehicles that are allowed to operate. The vehicles, parts, and components are all generally registered by the International Standards Organisation (ISO) and new cars generally are subject to 'type approval' standards to certify their quality, safety, and emissions. Motor vehicles are also generally registered with the police or motor vehicles department in case they are involved in criminal activity or are stolen. In developed countries and more and more developing countries, motor vehicles are also subjected to inspection to ensure compliance with tailpipe emission standards and roadworthiness.

A rickshaw in Ho-Chi-Minh City, Vietnam, January 2002

Karl Fiellstrom (taken from the GTZ Photo CD 1)

While production standards that ensure bicycles and components are of sufficient quality to not endanger the operator have been discussed, because of the complexity of the number of new manufacturers and new components, the process of approval by the International Standards Organisation is cumbersome and slow, and the cost high relative to the cost of the product. As such, the trend in the industry is to approve the quality control of a manufacturer rather than of a specific product.

In most developed and some developing countries, it is illegal to sell non-motorised vehicles without reflectors in the front and rear, as well as to operate the bike without the reflectors and front and rear lights if operated at night. Enforcement is generally lax. Some laws specify the use of reflectors of a specific quality standard. Some safety experts have suggested that requiring the bicycles and cycle rickshaws to be painted yellow might also solve the visibility problem, but the proposal seems to run against the strong desire to personalise the vehicle.

Finally, in some countries owners register their bicycles or other vehicles with the police. In some cases this is mandatory (as in Chinese cities) but in most it is voluntary and used primarily as a mechanism to facilitate recovery in case of a theft. Outside of China, bicycle registration as an anti-theft measure has not proven to be very successful. In Bogotá people can voluntarily register their bike with the police.

Imported motor vehicles also generally face tariffs and other user fees. These fees are generally reasonably progressive in developing countries where motorists tend to be from higher income groups, and where motor vehicle operation generates a lot of externalities, like wear and tear on the roadways and air pollution.

Bicycles, by contrast, tend to be used by all income groups, and in some developing countries their use is concentrated among lower income groups. Furthermore, bicycles do not generate significant externalities either in terms of wear and tear on the roadway or air

pollution. As such, tariffs on bicycles are somewhat more regressive. Tariffs on bicycles vary widely from country to country. In some Asian countries, tariffs on imported bicycles have been kept high to both protect domestic industry and to discourage non-motorised vehicle use. In Bangladesh, for example, in 1989, taxes on imported bicycles and most components were 150%, while import taxes on automobiles were only 50%, and on small transit vehicles, motorcycles, and trucks, only 20%. While some of these measures were aimed at protection against Indian bicycle manufacturers, for 80% of the components Bangladesh has no domestic manufacturing capability.

Since both India and China have joined the WTO, tariff barriers on bicycles in both countries are falling. Both countries have large low cost domestic bicycle manufacturing, but Indian bicycle manufacturers are already facing competition from Chinese imports and Chinese-owned manufacturers in Bengal.

5.2. Regulation of non-motorised vehicle operators

To operate a motor vehicle generally requires having a driver's license. This is because operating a motor vehicle is a skill that requires training, and untrained drivers are a risk to themselves and others. The relative simplicity of operating a bicycle or other non-motorised vehicle has made operating licenses unnecessary for commercial uses all over the world.

In some US states and municipalities the use of a bicycle helmet that is in conformity with a particular safety and quality standard is required by local law. In most developing countries helmet use is less regulated on bicyclists and even rare on motorcycles. In Bogotá, the use of helmets for motorcycles and

Basic mobility now costs less

Reducing bike tariffs

On June 13th, 2002, the Kenyan government announced the elimination of bicycle import duties. The decision comes on the heels of a rise in petrol prices, and should give a significant boost to bike sales and use. The International Technology Development Group in Kenya was a key force behind the decision.

The Tanzanian government has yet to remove bicycle import duties, although they have recently reduced the duty on bicycle tires by 10%. In a country where the average price of a bike is Tanzania Shillings 60,000 and the per capita income is Tanzania Shillings 270,000 per annum, this is an important first step but does not go far enough.

The Association for the Advancement of Low-Cost Mobility, (AALOCOM), the organisation that lobbied for the reduction, is taking their campaign farther, hoping to convince the government to follow Kenya's lead and reduce the duty on the entire bike.

The benefits of reducing or eliminating the tax are numerous. With access to this low-cost transportation, villagers can take grain to the market in larger quantity and more quickly; children in rural areas can reduce their travel time to school by hours; traditionally disadvantaged groups, such as women, can increase their access to self-employment opportunities. In short, the benefits of the reduction or elimination of the import duty are significant.

Adapted from ITDP sustainable transport newsletter, August 2002.

bicycles is now mandatory, but in the case of bicycles it is not enforced.

Many bicycling advocates oppose mandatory helmet laws as paternalistic (the only person affected is the operator himself and thus it should be their decision) and argue that they limit the use of bicycles. The effectiveness of helmets depends on the safety conditions created by the road infrastructure, the behavior of the cyclists, and the behavior of other road users. E.g. for short urban trips a helmet should be unnecessary due to safe infrastructure for cyclists and pedestrians. Therefore a general obligation to wear a helmet is generally out of order. In general authorities should not make a bicycle helmet law the focal point of cycling policy, but should instead focus on providing safe infrastructure. For racing and for small children, helmet use is more relevant.

5.3. Regulation of commercial non-motorised vehicle operation

Just as commercial motorised vehicles like trucks and taxis are subject to special regulations as commercial vehicles, some non-motorised vehicles like cycle rickshaws that operate as commercial vehicles are also sometimes subjected to further regulation as commercial vehicles.

Most commercial vehicles are regulated for at least three valid reasons:

1. to protect consumers
2. to limit adverse traffic-related impacts
3. to protect the operators.

In most first world cities, cycle rickshaw taxi services are relatively few. As such, they have remained completely unregulated. No licenses are required and fares are unregulated and negotiated on a case by case basis. They are required by municipal authorities only to hold insurance for the passengers in case of an accident. In European cities these vehicles are sometimes required to have a vending or operating license and in others they are not.

In developing countries, regulation of cycle rickshaws varies from country to country and

In Bogotá wearing helmets is mandatory even for cyclists, February 2002

Manfred Breithaupt
(taken from the GTZ Photo CD 4)

city to city. In Bogotá, the situation is similar to developed countries, as pedicabs are unregulated. Their numbers are only about 200, and they circulate only on main bike paths which were designed wide enough for their use in most places. These pedicabs are privately owned and have ads in the rear (advertising mobile phone and liqueur products) and there is no formal charge for their use, but a decent tip to the driver is expected for a home-to-work ride.

Often municipalities try to limit the number of licenses issued in order to reduce their total numbers. Reducing the total number of cycle rickshaws operating on the streets is reasonable. As with motorised taxis, an oversupply of cycle rickshaws will lead to large numbers of unoccupied vehicles cruising for passengers on the roadway, contributing to congestion. Furthermore, the profits per vehicle drop if there is an oversupply of cycle rickshaws. This prevents any cycle rickshaw operators from making a livable wage, and also undermines the profits that can be invested into modernizing their vehicles. A final reason to at least register cycle rickshaws is that they are often operated by transients who sleep in the vehicles. As such, they are sometimes suspected of criminality. Registering the operator and the vehicle will give local residents some protection against criminality.

The Indian Case

In most Indian cities where cycle rickshaws are allowed, operating them nominally requires a license. In Delhi, getting the license is often not easy and often requires going through a malek, (a fleet owner) who rents the vehicles or a financier (who sells the vehicle on credit at fairly high interest rates).

Rickshaws in Delhi

Jan Schwaab (taken from GTZ Photo CD 5)

Oddly, the vehicle licenses are issued by the Veterinarian Department of the Municipality because they were historically lumped together with animal traction vehicles. These regulations stipulate very specific sizing requirements that did not in fact correspond to any of the actual sizes of the mass manufactured models. They also required the presence of mud guards and a canopy for the sun, but do not require that the canopy be functional.

For these reasons, the general idea of registering cycle rickshaws and limiting their total number is a good idea. However, the way in which this is done can have a significant impact on the effectiveness of the regulation. In practice, the effort to restrict their total number has failed, but it has at the same time subjected cycle rickshaw operators to harassment from police and fleet owners who control the supply of actual licenses.

In Delhi, for example, there are an estimated 500,000 cycle rickshaws operating without a license, mostly in outlying areas. In the higher income and hence more profitable parts of the city, licenses are required, but while their numbers are not restricted, it gives control of the market to the maleks, or the big fleet owners, who form a kind of local mafia. Thus, the primary result of the licensing requirement is to allow maleks to extract extra rents from the cycle rickshaw walllahs.

In Surabaya, there is active discussion regarding the ability and desirability of limiting the numbers of becak operators. The ideal number, according to the becak union, is around 30,000 – 40,000, and there are currently around 42,000. Since 1974, the numbers of becaks have been officially regulated, but in fact the regulation does not work. Both the police and the Road Traffic Office make money from issuing the licenses, and as a result they are not extremely interested in regulating the total numbers. The becak unions, by contrast, support controlling the numbers as it would increase their income. Currently they pay Rp. 7,500 ($0.75) for a three year operator's license to the Road Traffic Office, and they pay a one-time Rp.40,000 fee ($4.00) to the police to have the permission to own the vehicle. In Yogyakarta, Indonesia, the situation is similar. Fees are paid to register the vehicle and to be allowed to operate the vehicle.

In Delhi, there have been discussions of scrapping the old licensing system controlled by the 'maleks' (financiers and fleet owners) and allowing anyone willing to pay a yearly fee to get an identification card to register to operate the vehicle for free. Another proposal has been to divide up the city into green zones, amber zones, and red zones. In green zones, there would be no restrictions on the number of vehicles allowed to operate. In the amber zones there would be restrictions on the number, and in the red zone they are not allowed to operate at all. This would more or less formalise the existing informal status quo, unless the zones are substantially changed.

The most interesting regulatory proposal was made by LPIST in Indonesia. They suggested that at the community or neighborhood level that the neighborhood committees should be allowed to determine the number of cycle rickshaws allowed to operate in the neighborhood, and these vehicles should be registered with the neighborhood level committees. Those with the operating license to operate in the neighborhood would form themselves into a small union, and the union would then protect their territory with the sanction of the neighborhood committee. This system was working well on an informal basis before the city-wide ban was reintroduced in 1998.

Becak drivers waiting for passengers in Surabaya, 2001
Karl Fjellstrom
(taken from GTZ Photo CD 1)

5.4. Review questions

1. What regulations on importation of non-motorised vehicles exist in your country? How does this compare to the regulation of motorised vehicles?
2. What type of enforcement mechanisms could be used to effectively regulate the operation of commercial non-motorised vehicle traffic?

6. Regulating the location of non-motorised vehicle use

6.1. Justificatons for restrictions on non-motorised vehicle access to some roads

As a general rule, travel between all trip origins and destinations should be protected as a basic human right. Most broadly protected are the rights of the pedestrian. Laws in the British Isles and in the Nordic countries protect the rights of pedestrians even to walk across private land, though in other countries no similar right exists and such access rights are governed by private property title deeds. The rights to access, moreover, are not generally extended to specific vehicles either motorised or non-motorised. While there have been some attempts to define a fundamental 'right to travel', there is no legal basis for singling out rights for any particular mode of travel. Courts generally allow municipal governments to restrict the use of specific vehicle types on specific roads, whether motorised or non-motorised. Clearly it would not be advisable to remove the power of local government to ban motorised vehicles from certain streets, as it would make pedestrian zones impossible, and motorised vehicles can kill pedestrians, and generate pollution, noise, and other negative externalities. The justifications for banning non-motorised vehicles, however, are much weaker.

In most countries, vehicle use of roadways is regulated through traffic codes. How non-motorised vehicles are treated depends on how they are defined in the traffic code. Some experts and cycling advocates believe that non-motorised vehicles should be legally treated exactly the same as all other vehicles, and deny the legitimacy of any special regulations for non-motorised vehicles as inherently discriminatory. However, such an approach could also be used to stop restrictions on motorised vehicles as similarly discriminatory.

To the extent that a justification exists for special NMV regulations, it should be based on their special operating characteristics. One important characteristic is that non-motorised travelers are 'weak' or 'vulnerable.' The 'Treaty of Vienna' from 1993 states: "Drivers should be extra careful to the most weak road users such as pedestrians and cyclists, particularly with respect to children, elderly people and disabled people". Another label is the term 'vulnerable', to make clear that pedestrians and cyclists are not protected in the way car drivers are to the speed and mass of motorised vehicles. The differences in weight, size, operating speeds, noise, and emissions of vehicles justify different regulations pertaining to their use.

While allowing for different treatment under the law of vehicles with different operating characteristics does tend to invite

Cycle rickshaws in Bangladesh Günter Zietlow

discriminatory treatment, this can be minimized so long as all vehicles with similar operating characteristics are treated in the same manner.

In most developed countries, bicycles and cycle rickshaws are defined as 'vehicles' under the traffic codes, and have all the same rights to use roadways as any other vehicle unless the traffic code specifically says otherwise. In most developed countries, however, there are special provisions in national, provincial, and local traffic codes pertaining to non-motorised vehicles and pedestrians due to their different operating characteristics. In developing countries, it is common for non-motorised vehicles to be a legal grey area. In Delhi, India, for example, cycle rickshaws are classified as agricultural vehicles, and in Yogyakarta, cycle rickshaws were not defined at all until a new law defined them as 'vehicles.' In many developing countries, non-motorised vehicles are not clearly defined in the traffic code, and their rights are not clear. In this situation, they are more likely to be harassed or victimized by traffic police. Clarification of their status as 'vehicles' is therefore an important first step.

Banning non-motorised travel has only been legally unambiguously justified on…

Roads where the safety of the non-motorised vehicle operator and passengers are currently endangered.

Non-motorised vehicles differ from motorised vehicles most importantly because they are more 'vulnerable' in the case of a collision. Banning non-motorised vehicle use on roads where there is a significant risk of dangerous accident is one way of dealing with this problem.

Libertarians and some cycling associations take issue with this, on the grounds that cyclists primarily endanger themselves, and not others, and as such restricting non-motorised vehicle access is paternalistic and hence should not be dealt with by the state. The courts, however, have tended to defend the rights of municipalities and other governments to restrict the use of non-motorised vehicles on some streets on safety grounds.

While in the short term, safety may be a legitimate justification for existing bans of NMVs on specific roads, the safety conditions are in fact a result of road design, and the regulation and enforcement of speed limits. Hence, in most cases it will be preferable to change the road design to make non-motorised vehicle travel safe, lowering speed limits, and enforcing slower speeds, rather than banning non-motorised vehicular traffic. Because non-motorised vehicle users are more 'vulnerable,' in many countries, an extra burden of responsibility is placed on motorists to be extra careful regarding pedestrians and cyclists. In the Netherlands, car drivers are in principle at least for 50% legal responsible for the consequences of an accident with a cyclist or pedestrian, regardless of who is 'at fault', to enforce road behavior that gives pedestrians and cyclists more equal rights for a safe, efficient and comfortable journey.

Kunming, China 2003

Karl Fjellstrom (taken from GTZ Photo CD 2)

Another possible justification for restrictions on non-motorised vehicle use on specific streets is as follows:

Roads where the aggregate social benefits of a non-motorised travel restriction outweigh the aggregate social costs, where a parallel route exists, and where the restriction does not make any population clearly defined as 'poor' worse off.

This is a more restrictive version of the World Bank position. The World Bank, in its urban transport policy, "***Cities on the Move: A World Bank Urban Transport Strategy Review***", has a broader definition:

"*Some cases (for example, major arterials designated for faster, longer-distance movements or urban busways) might justify the exclusion of non-motorised vehicles on both efficiency and safety grounds. Nevertheless, even in those circumstances, it is important that steps are taken to avoid serious severance of short-distance movements. Moreover, any decisions to restructure roads (for example to introduce new restraints on categories of use or to take away protected bicycle lanes) should be appraised in terms of the net benefit to all types of user and not merely in terms of the speed of motorised traffic.*" (p. 130)

The problem with this 'cost-benefit' type of assessment of non-motorised vehicle road access restrictions is that it ignores issues of social and environmental externalities and equity. Defining 'net benefits' as we have above to include estimates of the social costs of air pollution and accidents will address the first of these concerns.

The equity issue is that while many of the costs of restricting non-motorised travel will adversely impact low income operators and users of non-motorised vehicles, many of the benefits of such a restriction will tend to be captured by upper income private motor vehicle owners and taxi users. While the equity issue is not so clear-cut (many users of cycle rickshaws are of moderate income, and many bus passengers are of modest income), nevertheless there is little doubt that bans on non-motorised vehicles disproportionately affect lower income groups, and a net benefits calculation does nothing to stop a policy that could have severe adverse impacts on the poor. For this reason, we added language stating that the restriction does not make the poor worse off.

Main arterial closed for NMVs and other slow moving vehicles during rush hours - Nanjing China 2002

Karl Fjellstrom (taken from the GTZ Photo CD 2)

Dhaka's ban on cycle rickshaws on one corridor despite the fact that "*The average net monthly income of rickshaw pullers appears to have decreased by 32%,*" and "*In 36% of the families this resulted in a loss of food intake.*" has controversially been debated. Furthermore, the travel costs of families in the corridor increased by 9%. ("***Afterstudy on the Impact of Mirpur Demonstration Corridor Project***")

Local roads or neighborhoods where legitimate local governance bodies unambiguously are opposed to access by non-motorised vehicles.

Just as local communities should, through the democratic process, have the right to ban all motor vehicles on local streets within their jurisdiction, they should also have the power to restrict use by non-motorised vehicles, should this decision enjoy a local political mandate. While perhaps not our preference, should a high income neighborhood association choose to ban bicycle and cycle rickshaw access, it arguably should be within their power to do so. Conversely, in cities like Jakarta, where a decision by the governor banned non-motorised vehicles in the entire city, allowing their re-introduction to neighborhoods where there is a clear local mandate for allowing non-motorised vehicle access should be considered.

Another point of view is to claim that all destinations for people should be accessible by a bicycle and that in case of short trips, direct connections for cycling as for walking should have a higher priority than direct connections for motorised vehicles. The justification is first of all a matter of equity since accessibility on the bicycle is not dependent from high costs or a driver license so this principle enhances social inclusion. In the second place the principle is a matter of taking responsibility for the society and the environment since the external costs of cycling is much lower than of motorised vehicles.

This principle does not exclude banning cycling from roads with a flow function for cars or pavements for pedestrians. However it demands alternate routes with limited restrictions; it directs traffic and transport policies in favor of the needs of people over cars; it gives first priority in space allocation in urban areas to the requirements of pedestrians and cyclists before catering for motorised vehicles. This does not prohibit accessibility by cars to any destination. It just turns around the current bias towards cars that comes with claims that there is no space left for cycling any more into preserving urban areas as public space that should not be dominated by cars.

6.2. Basing non-motorised vehicle use restrictions on the road classification system

If we accept that safety and aggregate social benefits may be two legitimate justifications for restrictions on non-motorised vehicle use on specific roads, then it should be possible to loosely associate these restrictions with the road classification system.

It is well documented that the severity of roadway fatalities increases dramatically at speeds above 40kph. Furthermore, the competitive advantage of non-motorised vehicles lies primarily in short distance trips, where the time spent reaching a parking place or transit stop, and the time waiting for a transit vehicle to arrive, become an important part of total journey time.

Therefore, non-motorised vehicles are most inappropriate on high speed facilities serving long distance intercity trips, and most appropriate on slow and moderate speed facilities serving short distance trips.

Only one type of road is specifically designed for high speed long distance trips: **limited access highways.**

Restrictions on non-motorised vehicles are thus the most common on limited access highways. In New York State, for example, non-motorised vehicles are not allowed on Interstate Highways and Parkways. However, the ban on non-motorised vehicles on limited access highways is not universal. In some parts of the United States, non-motorised vehicles are allowed to operate on the shoulder of some limited access highways, if access to the road is necessary to avoiding cutting certain long distance cycle routes. Because most accidents occur at intersections or in locations where crossing is illegal, bicycle use even on very high speed roads is not that unsafe so long as there is a paved shoulder, a wide curb lane, or a fully separated bicycle path.

Limited access highways also generate serious severance problems, sometimes seperating

large numbers of short distance trips. Integration of new limited access highway design with careful crossing facilities for short distance, non-motorised travel is critical to ensuring that the benefits of the new highway are not undermined by the costs imposed on local short distance travel. In developed countries, state, provincial, and national laws increasingly include clauses which stipulate that transportation plans and projects shall provide due consideration for contiguous routes for non-motorised vehicles and pedestrians. Federal law in the US now stipulates that action that will result in the severance of existing or potential major non-motorised routes is forbidden unless a reasonable alternate route for this traffic already exists or is provided.

Addressing severance problems is also suggested in the World Bank's ***Environmental Assessment Sourcebook II: Sectoral Guidelines: Washington, DC : World Bank, 1991***

"*Pedestrians, animal drawn vehicles, and pedaled vehicles are important types of traffic on roadways in many countries, especially local roads and roads leading to major market towns. Upgrading of unpaved rural roads to paved standards that does not take into account the volume of such traffic will lead to unacceptable levels of accidents and displacement of slower modes of transport. An adequate number of safe crossings and separate or parallel restricted right of way for slow traffic should be incorporated into road and highway projects if there is existing or latent demand for non-motorised modes of transportation in the area.*" (p. 170)

Restricting non-motorised travel on limited access highways is generally less problematic than on any other road because all of the property owners in the corridor must have some other way to access their property. This is not true for any other type of road, including intercity highways, where property owners along the road may have no other access to the property. Banning non-motorised vehicles on any other type of road will make it impossible for some people living in adjacent properties to access their property other than through motorised means. Thus, as a general policy, non-motorised vehicles should never be banned on urban arterials unless an alternative non-motorised route exists to all affected properties. As such, it should be incumbent on authorities to provide facilities segregating motorised and non-motorised travel on roads with speeds over 40kph and where properties have no other access.

In developing countries, the development of limited access highways is a fairly recent phenomenon. More common are standard highways that remain accessible on both sides of the roadway to properties along them, and that pass through the center of towns and villages rather than bypassing them. Typically, such roads will serve both long distance high speed and short distance slower speed trips, particularly where the roads enter or pass through towns and cities. As such, they should be designed accordingly. Tanzania, for example, should be cited as a best practice case for designing. Many of its intercity highways have fully separated slow moving vehicle lanes, particularly where the roads enter towns. (see photo).

A standard highway within the city of Dar es Salaam

More frequently in developing countries there is no ban on non-motorised vehicles on intercity highways, but the roads are designed only for the convenience of high speed long distance for the safe operation of both motorised and non-motorised traffic, creating dangerous conditions. Obviously the preferred solution to this problem is to redesign the roadway and change the legal speed limits, rather than to ban slow moving non-motorised vehicles.

The explicit banning of non-motorised vehicles on intercity roads tends to correspond with the development of intercity limited access freeways, frequently financed by international financial institutions. The limited access freeway is a recent development in much of the developing world. Most of the new limited access freeways in China, for example, ban non-motorised vehicles. In such a case, effort should be made to establish a parallel non-motorised long distance network. England, for example, has recently completed a national non-motorised vehicle network, and similar networks are being developed throughout Europe.

A phenomenon largely absent in the West but increasingly pervasive in developing countries is the **flyover**. In Indian and Southeast Asian cities, for example, a growing number of cities are constructing strings of interconnected flyovers to mimic the performance of limited access highways. These facilities frequently exacerbate severance problems faced by short distance non-motorised modes. While a few flyovers have special slow moving vehicle lanes (in Delhi, for example), most of them are not open to non-motorised vehicles, or they are not designed to accommodate non-motorised vehicles. Providing special non-motorised vehicle lanes on surface streets under the flyover can partially mitigate this problem.

In developed countries, there is no general law prohibiting the use of non-motorised vehicles on broad categories of road types below limited access highways. Rather, non-motorised vehicles are allowed to operate on all other roads unless specifically prohibited under a state, municipal, or local ordinance. This is true despite the fact that most urban areas in the developed world have dense secondary road networks where parallel roads to major arterials are usually easy to locate. Most controversial have been restrictions on non-motorised vehicle access to certain

A flyover in Bangkok not designed to accomodate any non-motorised vehicles. Karl Fjellstrom (taken from GTZ Photo CD 1)

bridges, which frequently form part of a highway system but also connect local streets. The banning of bicycles on the Queensboro Bridge, connecting Queens and Manhattan in New York City, for example was the flashpoint of a demonstration with over 2000 cyclists. Currently, Federal and State laws in the US generally require that such facilities be designed with non-motorised vehicle facilities.

In developing country cities, however, **it is increasingly common to find restrictions on the use of non-motorised vehicles on primary and even secondary arterials**. While primary arterials generally constitute part of a network of roads intended to serve long distance higher speed travel, they generally also serve a large number of short distance slow moving trips, particularly in developing countries. In developing countries, it is typical for there to be a very limited secondary road network, concentrating the majority of both short and long distance trips onto the primary and secondary arterials. It is on these primary and secondary arterials that in an increasing number of Asian cities restrictions are being placed on non-motorised vehicles, and these decisions have frequently been extremely controversial.

In China and Southeast Asia, bicycles and other NMVs were allowed on all urban roads until the 1990s. In the late 1990s, however, bicycles in Chinese cities began to face increasing restrictions. In Guangzhou, for example, bicycles were banned on one of the most important urban arterials, Dongfeng Road. This made it impossible or very inconvenient for large numbers of short distance trips to be made only by bicycle. Numerous other Chinese cities have placed similar bans on bicycle use on major arterials. These regulatory changes, coupled with redesigning the physical infrastructure by tearing out bicycle lanes, have led to a dramatic decline of cycling in many of China's large East Coast cities. **In Guangzhou, for example, bike use dropped from 34% of trips in the early 1990s to around 16% of trips in 2000 .** These trips were almost entirely shifted to motorcycle and taxi trips, with a small increase in bus trips. The banning of bicycles on an increasing number of Chinese urban arterials has been justified primarily based on increasing motor vehicle speeds. In no case, it has a full appraisal of the impacts on all trips including cycling and walking trips conducted even when urban infrastructure has been financed under a World Bank project.

Bicycles are prohibited on many roads in Shanghai, with bans either full-time or during peak morning and afternoon periods. Above, cyclists, prohibited from entering a road, are forced to dismount and merge with slower-moving pedestrians.

Karl Fjellstrom, 2002

In South and Southeast Asia, while formal restrictions on bicycle use are few, a growing number of cities have begun to ban three wheeled cycle taxis, variously known as cycle rickshaws, pedicabs, or becaks. Some cities have banned them throughout the city (Jakarta, Bangkok, Bangalore), others in certain zones of the city (New Delhi, Manila), and still others on specific arterials (Surabaya, Dhaka).

Manila banned cycle rickshaws, initially on its main roads in the 1950s, then throughout the city. They reemerged on local streets in some areas after the economic crisis in the 1990s. Karachi banned cycle rickshaws in 1960, and Bangkok in 1962. Kuala Lumpur also banned them. In Jakarta, cycle rickshaws were banned in the 1980s, with selective enforcement. Surabaya, Dhaka, and Ho Chi Minh City restricted their use on certain major roads starting in the 1990s. These roads are spelled

out in specific municipal decrees. In Surabaya, they are also not allowed in industrial areas, new economic zones, and many new gated housing estates, mainly for image reasons.

If traffic planners are to avoid being accused of simple bias against a mode of travel depended upon by the poor, the elderly, women, and children, some coherent guidelines need to be established regarding when and how traffic system efficiency can justify the banning of cycle rickshaws.

Cycle rickshaws do have operating characteristics which make them less efficient users of road space than normal bicycles. They are wider, they move slower, they start and stop frequently, they take up public space while parked and cruising for passengers, and their capacity flow ratios are much lower than for bicycles. However, their capacity flow ratios are similar to those of motorised taxis and private cars with a single occupant, and all of these problems are also true for normal taxis and private cars. There is thus no traffic system efficiency justification for a blanket ban on cycle rickshaws in entire areas or on normal streets serving short distance and long distance trips where taxis and other relatively slow moving vehicles are allowed to operate.

The low vehicle procurement and operating costs, ready accessibility, and slow speeds make these vehicles the most efficient mode of travel for short distance trips in countries where labor costs are low, where the passenger is unable to operate or afford a bicycle, where packages or children have to be carried, and where distances are reasonably short.

While rickshaws are disappearing in many Asian cities due to restrictions, they are capturing new markets in Europe. Emerging in Berlin in the late 1990s, they set a new trend and proved popular with advertisers.
Manfred Breithaupt (taken from GTZ Photo CD 3)

Nonetheless, their image of backwardness and exploitation and the role they play in facilitating urban-rural migration has made this mode the subject of hostile government regulation which cannot be justified from a safety or traffic management perspective.

6.3. Should NMVs be required to use NMV facilities when they are provided

While in theory separating motorised and non-motorised travel through special facilities should be to the benefit of both, in practice bicycle lanes and pedestrian facilities too frequently offer a very poor level of service to these modes, and they are designed primarily to get non-motorised traffic out of the way of motorised traffic rather than to facilitate the safety and convenience of non-motorised modes.

In many countries where explicit NMV regulations exist, when bicycle or NMV use is allowed on a particular road, and no bicycle path is provided, non-motorised vehicles are required to operate in the curb (slow) lane except during turns. Similarly, in many countries, (including most cities in the US) if a bicycle lane or path is provided, and it is not obstructed, use of this bicycle lane or path is required by law. The most cycling-tolerant policies are found in Sweden and Germany, where cyclists are allowed to ride on the road even if a cycle track exists, if this is more suitable considering the destination, and if done with care.

Increasingly, experts feel that forcing cyclists to use curb lanes or cycling facilities where they exist is discriminatory, and oppose such regulations. In fact, some cycling advocates oppose segregated cycling facilities all together because they frequently serve to

Cycle lane in the central business district of Frankfurt where cyclists face conflicts with double parked vehicles and taxis picking up and dropping off passengers
Karl Fjellstrom (taken from the GTZ Photo CD 3)

justify forcing cyclists to use sub-standard facilities.

In the curb lane, cyclists face conflicts with turning vehicles, double parked vehicles, taxis picking up and dropping off passengers, stopping buses, and numerous other conflicts that slow down travel in the curb lane. On roads with travel speeds 60 km/hr or less, an increasing number of cyclists are able to maintain these speeds and do not want to be forced onto curb lanes when motorists are not.

Bicycle paths vary widely in terms of the level of service they offer cyclists. A law which requires all cyclists to use cycling lanes even when they are narrow, poorly maintained, obstructed by pedestrians and other obstacles, and designed for speeds easily surpassed by advanced cyclists, are a great nuisance to an experienced cyclist.

Minimum design requirements could help to improve the quality of cycling facilities and to justify neglecting behavior by cyclists if the provisions do not comply to the guidelines. Increasingly in the US and in Europe, and in some progressive developing country cities, laws actually require that any new facility on which non-motorised vehicles and pedestrians are allowed be designed to facilitate safe pedestrian and cyclist use.

6.4. Determining what types of vehicles should have access to NMV facilities

As the diversity of vehicle types continues to expand, there are an increasing number of conflicts over which types of vehicles are allowed on which types of facilities. It is often difficult to design high grade facilities specifically for bicycles while restricting access for motorcycles. It is often difficult to

A pedestrian overpass crossing one of Bangkok's arterials, December 2001
Karl Fjellstrom (taken from GTZ Photo CD 1)

keep pedestrians out of bicycle lanes, and also to keep bicycles off sidewalks. Cycling and walking facilities shall go along with each other.

Do bicycles belong on sidewalks or in pedestrian zones?

While differences in operating characteristics between slow moving vehicles like bicycles, and scooters and pedestrians may be quite modest, they may nonetheless be sufficiently large as to create a nuisance for pedestrians. The pedestrian environment should be designed as a public space with multiple functions, some of which are unrelated to through-travel. Pedestrian zones and sidewalks should be designed as places where people can relax without worrying about being bumped by a bicycle. As such, in general bicycles should be kept off sidewalks, though people are generally permitted to get off their bicycles and walk them.

Some consideration should be taken, however, for differences in local conditions. In many low density urban and suburban areas in the US sidewalks are underutilized, and use by bicycles will cause few conflicts. However, for children under 14 years of age, traffic laws generally do not allow them to operate a bicycle in the street unsupervised by an adult. As children do not generally operate their vehicles at very high speeds, normally children are allowed to operate bicycles on sidewalks but not on the roads.

An electric scooter in a pedestrianised area in Shanghai

Manfred Breithaupt (taken from GTZ Photo CD 2)

Do pedestrians belong on bicycle lanes or shared use facilities?

Just as bicycles do not generally belong in pedestrian zones, similarly pedestrians do not generally belong on bicycle paths unless the facility has been specifically designed for mixed pedestrian and bicycle use. In Tokyo, for example, some roadside facilities have been designed for mixed use by cyclists and pedestrians. As such, they are very wide facilities. While these facilities are frustrating for cyclists due to the large number of conflicts with pedestrians, they do provide bicycle access to areas with very high pedestrian volumes.

Do roller blades, cycle rickshaws, and motorised slow moving vehicles like mopeds, motorised scooters, electric bicycles, motorcycles, etc. belong on bicycle lanes?

There are also debates about whether roller blades, motorcycles, mopeds, motorised scooter, electric bicycles, cycle rickshaws and other vehicles should be allowed on bicycle lanes. Roller bladers have very different operating characteristics from cyclists. While their operating speeds and weight are similar to a bicycle, they consume much more lateral road space than cyclists. As such, they should probably be tolerated on bicycling facilities that are of reasonable width.

Similarly, cycle rickshaws share many operating characteristics with bicycles, with the exception that they are much wider. In Bogotá, for example, cycle rickshaws are currently not allowed on the new bicycle paths recently constructed, and these facilities were generally not designed to accommodate non-motorised vehicles of such width, though there is currently an effort to change the law. In Lima, bicycle lanes designed under a World Bank project did not anticipate use by non-motorised three wheelers, and hence were designed to too narrow a standard to accommodate their use. Certainly, it is preferable to design bicycle paths to accommodate cycle rickshaws where possible.

Mopeds, motorcycles, electric bicycles, and motorised scooters, are generally heavier vehicles, sometimes generate pollution, and generally have the capacity to go much faster than normal bicycles. As such, they generally belong on normal, mixed traffic facilities rather than on bicycle paths. Their presence on normal bicycle facilities will tend to be a nuisance to ordinary cyclists, and tend to depress bicycle use in favor of the motorised modes which have higher social costs related to their use. As such, restricting the use of these modes on bicycle paths is perfectly justifiable.

The Netherlands and Belgium allow motorcycles on some bicycle paths, but their numbers remain fairly few. Chinese, Malaysian, and some other cities don't allow motorcycles on some major roads, and force them to use 'bicycle' lanes. With the growing number of electric bicycles in China, this is a growing issue. China is currently trying to decide whether to require electric bicycles to operate on bicycle lanes or on normal traffic lanes. Currently it varies from outright bans in central Wuhan to legal limbo in Beijing to required operation in cycle lanes in Shanghai, Kuala Lumpur and Malaysia, which has an extensive network of shared bicycle and motorcycle facilities. The motorcycle speeds, noise, and pollution tend to drive off the ordinary cyclists.

While we generally recommend therefore that these modes not be allowed on bicycle paths, designing the bicycle path for slower speeds, enforcement of speed limits on the facility, and very tight emission and noise controls on the motorbikes would mitigate many of the conflicts between these two modes.

6.5. Determining right of way between motorised and non-motorised vehicles

There are a host of subtle ways in which traffic laws can be biased in favour of cyclists and pedestrians or in favour of motorists.

In the Netherlands, for example, a cyclist going straight has the right of way over a motorists turning in front of the cyclists, and

NMT lane in Changzhou, China, with restricted access for motorcycles

Manfred Breithaupt (taken from GTZ Photo CD 2)

motorists are not allowed to overtake a cyclist just before an intersection. In the US the motorist frequently has the right of way. In Switzerland, when a bicycle path is more than 2 metres from the road, turning motorised vehicles have the right of way over cyclists going straight at an intersection. Such laws are extremely hostile to non-motorised travel.

The rules with respect to bicycle turning movements also differ. In some countries cyclists may choose to turn directly, manoeuvring to the middle of the road before the crossing like a motorist. In other countries cyclists are not allowed to cross in a direct way but must stay in the curb lane and cross with pedestrians. This is restrictive for cyclists and has to be balanced with safety conditions.

Therefore, sharing a sidewalk is not a good option in general. Pedestrian areas could permit cycling on the condition that cyclists adapt their behavior not to threaten pedestrians.

6.6. Recommandations

Non-motorised vehicles themselves should not be required to meet road worthiness tests.

However, particularly commercial non-motorised vehicles should be required to have proper reflectors.

Private non-motorised vehicle operations should not require an operating license, and helmet use should be optional.

Regulations restricting access of non-motorised vehicles to specific roads should be limited to:

- Roads where the safety of the non-motorised vehicle operator and passengers are currently endangered and an alternative route exists.
- Roads where the aggregate social benefits of a non-motorised travel restriction outweigh the aggregate social costs, where a parallel route exists, and where the restriction does not make any population clearly defined as 'poor' worse off.
- Roads in neighborhoods where legitimate local government through a democratic process unambiguously opposed access by non-motorised vehicles to local streets.

These conditions are only likely to be regularly satisfied on limited access highways. In all cases it is preferable to redesign the road or to create a direct alternative route in question for safe travel by non-motorised modes.

Laws requiring that non-motorised vehicles use any existing non-motorised facilities, be they sidewalks, bicycle paths, or pedestrian overpasses, should be avoided. However, where such laws do exist, it is particularly important that for the law to be applicable the non-motorised transport facilities meet a high quality design standard, are properly maintained, and not obstructed.

Regulating the total number of commercial non-motorised vehicles can benefit the operators, the public, and reduce the number of cruising non-motorised vehicles. However, legitimate associations of non-motorised vehicle operators should be involved in establishing the regulatory regime, and the measures should be self enforcing to the extent possible.

6.7. Review questions

1. What legitimate justifications exist for regulating non-motorised vehicle access to specific roads?
2. What legitimate justifications exist for regulating commercial non-motorised vehicle operation, and how might this best be implemented.
3. What is the historical background of NMVs in your city? Try to find some historical pictures to document conditions half a century ago.

7. Regulating the design of Non-motorised transport facilities

7.1. Design standards and the law

In the previous chapter, unsafe conditions faced by pedestrians and cyclists on specific roads were cited as a legitimate basis for banning non-motorised access to these roads. However, the safety conditions on the road are a function of the road's design. If the function of a road is to serve both short distance slower moving traffic and long distance traffic, (in other words if the road is any type other than a limited access expressway), **proper road design standards should be able to ensure that there is never any cause for banning non-motorised travel based on safety**. Combination of access and flow functions should be prevented as much as possible. A road with an access function should be available for cyclists and pedestrians and not allow for high speeds. If such a road is the only one available for through traffic, the lay-out should limit speed. If a road only has a flow function, higher speed can be allowed but in that case cycling and walking should both be facilitated by segregated tracks or an alternative direct route should be available.

In the period of 1938 until 1944, seven 'geometric design policies' were written by the Committee on Planning and Design Policies of the American Association of State Highway Officials, and these became the basis of US roadway design standards. These early standards suffered from three important flaws. The first was that the standards were focused primarily on the safety of the motorist rather than non-motorised road users. The second was that the design standards were based more on speed than on safety. The third was that the assumptions made about road safety later proved to be completely wrong.

The decline of non-motorised travel in developed countries was not brought about primarily as a result of legal restrictions on non-motorised vehicle use. Rather, growth in private motor vehicle use was accompanied by a fundamental change in roadway design that facilitated high speed motorised vehicle travel, often at the expense of safe non-motorised travel.

Design standards are generally developed to make an industry more efficient and to protect consumers. With roadway designs standardized, engineering companies did not have to re-design every road to fit a particular location but could use standardized designs and procedures. Highway design standards in the US also ensured safer and more efficient motor vehicle operation. These changes were eventually codified into design standards. Laws and regulations were then passed which cite these design standards, which were then codified into design manuals that were only periodically updated.

A road with flow-function in Bogotá offering seggregated cycle lanes in the median strip - Photo taken during Ciclovia (car free sunday) Shreya Gadepalli

Unfortunately, the roadway design standards that emerged were developed for the National Highway System, in conditions where it was appropriate to facilitate high speed motorised travel at the expense of slower speed non-motorised local travel. However, they came to be also applied to conditions where it would have been more appropriate to favour safe and convenient short distance non-motorised travel. As a result, the design standards often led to conditions that were unsafe for non-motorised travel, and non-motorised travel declined sharply.

These design standards were then applied without significant modification in developing countries where conditions were dramatically different, where for example non-motorised traffic constituted the vast majority of total trips rather than a small minority of trips.

A look at the roadway design manuals used in South Africa, for example, shows that they were clearly adopted from US and Western European design manuals perhaps 25 years out of date in conditions where there was little non-motorised travel. As Roger Behrens found in ***Matching Networks to Needs: Travel needs and the configuration and management of local movement networks in South African cities***, "*The evolution of South African codes of practice … illustrates how the accommodation of the travel needs of low-income groups (or 'developing communities') was essentially considered within the basic framework of a local network configuration idea developed out of a consideration of the travel needs of middle and high-income groups (or developed communities').*" In South Africa, where only the small white minority could afford motor vehicles, such road design standards served to reinforce apartheid.

In both developing and developed countries, there is rarely a direct link between the road's design standards and the legality of non-motorised access to the facility. As a result, around the world there are many examples of facilities where access by non-motorised modes is allowed but where roadway designs are unsafe for non-motorised travel. There are also examples of other facilities where non-motorised travel is proscribed, but conditions for their operation are reasonably safe.

Arterial in Bangkok without any cycle infrastructur - a typical situation for most of the city.

Karl Fjellstrom (taken from the GTZ Photo CD 1)

For example, in the past few decades, British traffic authorities have been converting Zebra crossings (striped, unsignalised crosswalks) into Pelican crossings (**Pe**destrian **Li**ght **C**ontrolled crosswalks) under the hypothesis that more control would increase safety. However, the law regulating walking behavior was not updated to require pedestrians to obey the new signals. They could, and did, cross regardless of the signal, to the consternation of motorists who felt they had the right of way. Recent research has shown that Pelicans do not increase safety, and in some instances are more dangerous than a standard Zebra. This brings up the question, who is acting with impunity, the pedestrians or traffic authorities? (For more info, see Drive and Stay Alive http://www.driveandstayalive.com/).

Another example of this conflict is in New York City where it is permissible to cross the street between two intersections (midblock), but not if **both** of the adjacent intersections

have traffic signals. If one of the intersections has a signal and one has a stop sign, then you can cross midblock. It can be said that relatively few people know of this statute, and if they did, would probably not obey it. Similarly, the traffic authorities refuse to sanction midblock crossings, believing them to be unsafe (albeit legal).

It is therefore important that design standards reinforce existing laws, and vice versa. In designing a road, one implicitly dictates lawful actions, from vehicle speed to crossing locations. This does not give the designer the license to curtail legal behavior, or encourage unlawful ones.

Because the design standards that emerged were largely designed to improve the quality of motorised travel and all but ignored the concerns of non-motorised travel, non-motorised vehicle operators face strong incentives to disobey traffic laws. One way street systems increase throughput speeds but at the expense of the directness of access. This roadway design increases the efficiency of fast moving motorised traffic at the expense of slow moving non-motorised traffic, giving non-motorised vehicles a strong incentive to go the wrong way down a one way street. In many cities in Europe one-way-streets are open for cyclists in both directions. This however requires a high degree of safety education and awareness. The speed on those roads is limited. Cycling through cities with Area Traffic Control Systems, like New York City, one inevitably hits traffic signals during the red phase because the signals have been timed to facilitate constant motor vehicle flows at speeds too high for cyclists to maintain. As a result, cyclists feel quite correctly that the traffic system is not designed in their best interest, and they have a strong incentive to run traffic lights. One way streets and signalized intersections are not even necessary if all of the traffic is non-motorised, or when roads are designed to force motorised traffic speeds below 40kph.

Contraflow cycling on one way streets with a speed limit of 30 km/h is officially allowed in many residential areas of Frankfurt Germany

Stefan Nagelschmitt, 2005

Therefore, for traffic regulations to be largely self-enforcing, design standards must fairly balance the travel needs of both motorised and non-motorised travel.

In the past two decades, a fundamental re-appraisal has begun of roadway design standards, and a growing number of countries have begun the process of changing roadway design standards to give greater attention to safe and convenient non-motorised travel. However, ‚ost of these newly emerging design standards were developed in and for developed countries, where non-motorised vehicle volumes are a fraction of those observed in many developing countries. For example, in the US today, less than 1% of daily trips are made by non-motorised vehicles. As such, design standards appropriate for non-motorised travel in a developed country like the US may be inappropriate or insufficient to the conditions faced in a developing country context where bicycles may make up as much as 40% of the modal split. For example, no design standards have yet been set which can ensure that specific high volumes of non-motorised vehicles can reach a certain level of service. Appropriate designs for these conditions are only in the initial stages of development.

However, there is a fast growing track record on North-South cooperation between countries with a high level of cycling. Dutch, and also many German and Danish cities, do have a share of 20 to 40% of urban trips by cycling. This goes along with a reduction of road space

for cars to one lane and high capacity cycling facilities, in combination with priority measures for through traffic on the bicycle and priority measures for cyclists at crossings. The Locomotives program from I-ce Interface for Cycling Expertise supports civil society organizations, governments and expertise agencies in developing countries with capacity building and technical assistance to create a better balance in space allocation between different modes of transport that serve accessibility and higher road safety standards for all road users.

7.2. Establishing a non-motorised transport planning and design process

The problem of lack of appropriate design standards for non-motorised travel is often exacerbated by lack of clear institutional responsibility over non-motorised transport. Typically the police, the department of public works, the department of transport, the city planning agency, the department of parks and landscaping, and other departments, will all have authority over different areas of critical concern to non-motorised transport. This inter-departmental confusion exists not only in developing but also in developed countries. Sidewalks may be the responsibility of a department of parks and landscapes, but a state telephone operator might place a large decorative telephone booth in the middle of the sidewalk, completely obstructing the walkway and forcing pedestrians into the street.

Further, since the design of non-motorised transport facilities is still an emerging science, it is often as important to designate responsibility for making decisions on non-motorised transport facility design in the absence of clear-cut design guidelines, as such guidelines appropriate to the developing country context still do not yet exist.

For this reason, an important first step in the development of appropriate design standards for non-motorised transport is to establish clear institutional responsibility over non-motorised transport.

Secondly, it is also typically a problem that the users of non-motorised vehicles are concentrated among lower income people. The transportation planners and engineers responsible for designing the facilities are frequently motorists who have no direct experience with non-motorised travel and no intention of ever using the facilities designed for non-motorised travel.

For this reason, it is very important that a mechanism be established for making design decisions over non-motorised transport facilities that directly involves pedestrians and the users of non-motorised vehicles in the planning and design process.

In the developed world, an increasing number of state or provincial laws mandate the creation of a special Non-Motorised Transport Coordinator (or Bike coordinator), and a Non-Motorised Transport Task Force. The Coordinator and the Task Force are then given certain regulatory powers.

Ideally, the Non-Motorised Transport Task Force will have representatives from not only all state (provincial) and municipal agencies involved in issues affecting non-motorised transport, such as the police, the road traffic agency, public works, city planning, the city council, etc, but also from civil society. At least one should represent non-motorised vehicle users groups (such as a becak union or cycling advocacy organisation) and there should be at least one representative of the private sector. This group in turn generally selects a chairman.

The Non-Motorised Transport Task Force, led by its Coordinator, is generally responsible for promoting and facilitating the safe and convenient use of non-motorised modes of transportation. They should be given the right to modify new infrastructure projects based on their impact on non-motorised transport modes, they should supervise the inter-agency efforts needed to design and implement the development of facilities for pedestrians and non-motorised vehicles, and public education, promotion, and safety programs.

In other words, it is as important to regulate the process by which design standards are

developed as it is to develop specific non-motorised transport design standards.

7.3. Design standards and design manuals

In most countries, developed and developing, the law tends to authorise certain branches of government (or in a few cases professional associations of civil engineers) to develop design standards for new highways and for the configuration and signage on existing roadways. These design standards are usually found in design manuals that are periodically reviewed and updated. For a summary of US federal law pertaining to roadway design manuals, see the supporting documentation CD-ROM.

One that has had a significant impact around the world is the US American Association of State Highway and Transportation Officials' (AASHTO) ***Policy on Geometric Design of Highways and Streets*** (the Green Book). This book sets parameters for geometric design of highway and roadway facilities. In the US, all roads that are defined as part of the National Highway System (NHS) must adhere to these design standards. Other roads, even those receiving federal funds, can be designed to different standards. Most US states have also passed laws authorising the State Departments of Transportation (DOTs) to set up design standards, and these standards are generally based largely on the Green Book.

A road in the heart of Frankfurt, Germany, retrofitted bicycle lane, March 2002
Karl Fjellstrom (taken from the GTZ Photo CD 3)

A recent History of Road Law and Policies in Germany

The case of Germany, a large and populous country with fairly progressive transport policies, presents a good example of how difficult it is to change road laws and policies. As a timeline of German road law (see next page) highlights, in 1979 government and industry groups set about to issue more progressive design guidelines. Six years later, in 1985, the revised guidelines for toll roads were released. Not until fourteen years later, in 1993, were new guidelines for arterials approved.

Recent History Of German Laws & Policies Affecting Cyclists

1961	German League of Cities (DST) calls for pedestrian-only zones
1977-78	Nordrhein-Westfalen (NRW), the most densely populated state, sponsors 30 model traffic calming projects.
1979	Federal Ministry for Regional & Urban Planning & Development (BMBau) publishes Traffic Calming: a Contribution to Urban Renewal.
1979	Federal Ministry for Regional & Urban Planning & Development (BMBau) publishes Traffic Calming: a Contribution to Urban Renewal.
1979	BMBau promotes a model cycle-friendly town plan for cities of 30,000 to 100,000 population.
1980	"Traffic-calmed street" (walking speed) sign adopted nationwide.
1980	BMBau publishes *Residential Street of the Future.*
1982-86	BMBau produces series of traffic calming primers.
1980-90	Federal government sponsors six model traffic calming pilot projects nationwide (Berlin-Moabit, Borgentreicht, Buxtehude, Esslingen, Ingolstadt, Mainz-Bretzenheim)
1983	NRW sponsors Quiet Living - Safe Streets competition among 44 towns.
1984	German League of Cities (DST) calls for reductions in vehicle speeds and crashes in cities and towns.
1985	Road and Transportation Research Association (FGSV) publishes Recommendations for the Design of Access (Collector) Roads. [These guidelines are not mandatory as were previous design regulations issued by the federal government.]
1985	NRW's Ministry for State & Town Development gains authority over traffic policy.
1985-89	Car lobby opposes area-wide low speed (30 km/h) zones except as tests.
1988	DST promotes three tiered system for traffic speeds: 40-60 km/h on principal arterials, walking speeds in residential areas, and 30 km/h on all other roads.
1989	10 & 20 km/h business zones sign adopted nationwide.
1989-93	NRW sponsors bicycle friendly pilot programs.
1990	30 km/h zones widely established.
1991-96	Heidelberg, Münster and Tübingen establish Traffic Forums whereby traffic policy is bargained among competing user groups & agencies and facilitated by a neutral moderator.
1993	FGSV publishes Recommendations for the Design of Main (Arterial) Roads. [These guidelines are not mandatory as were previous design regulations issued by the federal government.]
1993	Ability to regulate number of parking spaces per building returned to the cities from the states - clearly allowing car-free developments.
1995	FGSV updates Recommendations for the Design of Access (Collector) Roads.
1995	FGSV publishes Recommendations for the Design of Cycling Facilities.
1997	Two-way cycling on one-way streets w/ speed limits of 30 km/h or less adopted as trial until 31 Dec 2000.
1997	'Cycle Streets' established whereby driver must not pass and yield to cyclists.
1997	Cyclists permitted to ride in bus lanes.
1997	'Shared cycle lanes' established where cyclists have priority but wider vehicles (trucks & busses) allowed to use when and where necessary.
1998	Law passed declaring that cyclists only have to use cycle lanes if they are 1.5m (5') wide and in good shape. Cities had to remove signs for sub-standard lanes.

In developing countries, design standards have historically been based on standards from developed countries, modified somewhat to meet local conditions. The prevalence of the US Green Book in setting roadway design standards has historically been problematic. It was developed originally with very little acknowledgement of the existence of non-motorised travel. As such, earlier versions of these standards, which have been around since the 1930s, propagated infrastructure designs that were neither safe nor convenient for non-motorised travel. Still today the Green Book provides little guidance for either cycling facility design or pedestrian facility design. However, for cycling facilities, it now refers to a new 1999 publication, ***Guide for the Development of Bicycle Facilities***. In the US, most State DOTs have adopted this guide as the basis for bicycle facility design standards. These standards are something of a compromise between the wishes of the bicycle advocacy community and what will be tolerated by the highway engineering community.

For pedestrians, the Green Book stipulates only that pedestrian facilities (sidewalks and crosswalks) should be sufficiently wide to handle the volume of pedestrian traffic safely, and recommends the use of refuge islands, street lighting, and multiple visible pedestrian crossing signs at intersections. However, in 2004 AASHTO published ***Guidelines for Planning, Design and Operation of Pedestrian Facilities***. While this is a relatively conservative document, it is a welcome first step in the United States. It will be useful in the developing world to show that the US is becoming serious about pedestrian access and safety.

In developing countries, however, governments would be well advised to look towards countries like the Netherlands with much greater experience in bicycle and pedestrian facility design.

The Dutch ***Sign up for the Bike: Design Manual for a Cycle-Friendly Infrastructure***, published by the Centre for Research and Contract Standardisation in Civil and Traffic Engineering - The Netherlands, is often cited as a much better guide for cycling facility design. 'Sign up for the bike' grounds the design process in five criteria for quality bikeway design:

- **Safety**
  (the infrastructure guarantees the road safety of cyclists and other road users);
- **Comfort**
  (the infrastructure enables a quick and comfortable flow of bicycle traffic);
- **Attractiveness**
  (the infrastructure is designed and fitted in the surroundings in such a way that cycling is attractive and that cyclists can easily find their routes and destination);
- **Coherence**
  (the infrastructure forms a coherent unit and links with all departure points and destinations of cyclists);
- **Directness**
  (the infrastructure continually offers the cyclists as direct a route as possible).

Integration of these requirements results in the highest levels of cycling. In Western Europe, every substantial increase of the share of cycling went along with a decrease in the absolute number of cycling fatalities. This is not so much a result of the safety of cycling provisions. The integration of all requirements for cycling leads to traffic calming of motorised vehicles. The result of the different interventions is much higher road safety standards for all users including cyclists and pedestrians. The Netherlands, with a 28% share of all trips by bicycle, belongs to the top 5 in the world with respect to road safety standards.

7.4. Design standardization versus design flexibility

The US highway design standards were originally developed to ensure the standardized construction of the National Highway System. As this system reached completion, and as federal money increasingly came to be used for the upgrading of smaller roads through towns and environmentally sensitive areas, the same design standards

were inappropriately applied to lower level roads, with detrimental effects on safety and the environment. As planners came to realize that the design standards set forth in the Green Book were inappropriate in a growing number of conditions, in the 1990's these standards came under attack for being too conservative and rigid for urban or environmentally sensitive projects.

In 1997, the federal government produced a report entitled ***Flexibility in Highway Design***, 1997, which called on highway designers to pay more attention to the surrounding context. One size did not necessarily fit all. In 2004, AASHTO responded with ***A Guide for Achieving Flexibility in Highway Design***, which attempts to integrate this new thinking into their design guidelines.

Flexible Design Standards

In the 1990's, guidelines for road construction came under attack as too rigid for urban or environmentally sensitive projects. The result was guidelines that sought to incorporate more flexibility.

In the United States, guidelines for construction roadways came under attack in the 1990's as too conservative and rigid for urban or environmentally sensitive projects. Since WWII the push had been to complete the national roadway network of interstate highways. Now that is essentially complete, smaller roads through towns and wetlands were being upgraded, often with detrimental effect. The federal government produced a report entitled Flexibility in Highway Design, 1997, which called on highway designers to pay more attention to the surrounding context. One size did not necessarily fit all. In 2004, AASHTO responded with A Guide for Achieving Flexibility in Highway Design, which attempts to integrate this new thinking into their design guidelines.

Flexibility in Highway Design states the following:

"*This Guide is about designing highways that incorporate community values and are safe, efficient, effective mechanisms for the movement of people and goods. It is written for highway engineers and project managers who want to learn more about the flexibility available to them when designing roads and illustrates successful approaches used in various highway projects. It can also be used by citizens who want to gain a better understanding of the highway design process. The challenge to the highway design community is to find design solutions, as well as operational options, that result in full consideration of sometimes conflicting objectives. This Guide helps meet that challenge by provoking innovative thinking for fully considering the scenic, historic, aesthetic, and other cultural values, along with the safety and mobility needs, of our highway transportation system.*"

AASHTO describes their report ***A Guide for Achieving Flexibility in Highway Design*** as follows:

"*Context-sensitive solutions (CSS) reflect the need to consider highway projects as more than just transportation facilities. Depending on how highway projects are integrated into the community, they can have far-reaching impacts beyond their traffic or transportation function. CSS is a comprehensive process that brings stakeholders together in a positive, proactive environment to develop projects that not only meet transportation needs, but also improve or enhance the community. Achieving a flexible, context-sensitive design solution requires designers to fully understand the reasons behind the processes, design values, and design procedures that are used.*

This new AASHTO Guide shows highway designers how to think flexibly, how to recognize the many choices and options they have, and how to arrive at the best solution for the particular situation or context. It also strives to emphasize that flexible design does not necessarily entail a fundamentally new design process, but that it can be integrated into the existing transportation culture. This

Design Flexibility: Differences in Stopping Sight Distance

States have flexibility in setting their own guidlines, though the choice of which design standards to follow has a tremendous effect on road safety for non-motorised transport users. A comparision of stopping sight distance illustrates this.

In the report *Flexible Design of New Jersey's Main Streets*, various research from the Green Book, state design manuals and other sources is compared to show how they differ. One of the key differences that emerged is 'stopping sight distance.'

Stopping sight distance standards from various sources:

Design speed (km/h)	1994 AASHTO (m)	2001 AASHTO (m)	Median values from other countries (m)
40	44	46	35
50	57	64	50
60	74	83	70
70	94	105	90
80	113	129	115

(Other countries include Australia, Austria, Canada, France, Germany, Great Britain, Greece, South Africa, Sweden, and Switzerland.)

These changes in stopping sight distance (SSD) standards have real implications in roadway design. SSD is the measure of how long it takes a driver to stop the car after first seeing a danger. For example, a driver should be able to see a person about to cross the street in time to stop for that person. The critical indicators of SSD are speed, distance, lateral placement, and visibility. In urban areas with buildings near the roadway, bicyclists on cross streets are often hidden from view. Slowing traffic is one way to deal with this phenomenon. Removing the building is another. The 25m difference in SSD at 70 km/h (90m to 105m) has a tremendous effect on this decision making process.

Source: *Flexible Design of New Jersey's Main Streets*

publication represents a major step toward institutionalizing CSS into State transportation departments and other agencies charged with transportation project development."

Giving local planners and engineers greater flexibility in highway design allows them to develop more non-motorised transport friendly designs, but it also allows them to use non-motorised transport unfriendly designs in conditions where they are inappropriate. While more non-motorised transport friendly design standards would be preferable, more flexible design standards are probably an important first step in that process.

7.5. Linking design standards to speed limits and the road hierarchy

Appropriate roadway design and speed limits depend on the function of the road. A road where the vast majority of trips are long distance high speed motorised intercity trips should be designed differently and have a different speed limit than a road where long distance motorised trips are evenly balanced with short distance motorised and non-motorised trips.

Linking appropriate roadway design and roadway speed limits to the road's function is an important first step in ensuring that design standards and traffic laws are mutually reinforcing and self-enforcing.

Because design standards are developed for specific operating speeds, governments are also dictating appropriate design standards when they set speed limits on specific routes. In New York City, for example, the State of New York set the state minimum speed limit at 25 miles per hour (40 km/h). The risk of a

child being killed when being struck by a motor vehicle at 40 km/h is very high. Because of limited public space in many New York City neighborhoods, local streets are often also used by children for playing. While widely known traffic calming measures could easily have forced traffic on such local streets to slow down to safe speeds, it was illegal in New York City to design the road in a way that motor vehicles could not operate safely at 40km/h. As a result, the traffic calming measures needed to protect New York City children were illegal until advocacy groups managed to get the Slow Speed Bill passed which repealed the residential minimum speed limits, allowing the City to selectively reduce minimum speed limits on some streets.

While the link between speed limits, road function, and design standards remains tenuous in developed countries, in developing countries the road hierarchy has frequently never been defined, speed limits may be undefined and unmarked and not enforced, and engineers are not sure which design standard to use for a given roadway.

In Surabaya, Indonesia, for example, a road classification system and road hierarchy has been defined, with allowable speed limits associated with the road classification, but there was no correlation between the road design and the road classification, no traffic police were aware of the legal speed limits, no speed limit signs were posted anywhere in the city, and citations for speeding were unheard of. A ban on the use of cycle rickshaws existed on several secondary arterials, but it did not exist on several primary arterials, despite there being no clear difference in roadway design. Design standards are meaningless unless they are associated with a clear functional road hierarchy and corresponding speed limits.

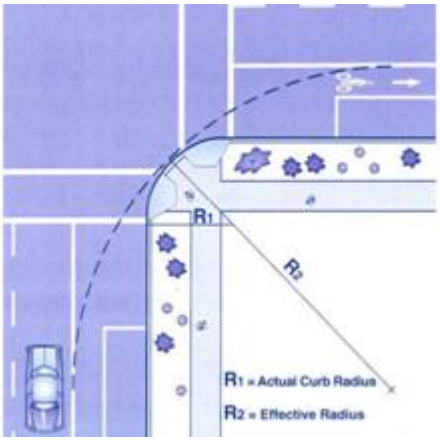
In China there is currently a national effort to increase motor vehicle traffic speeds on all urban roads through roadway design changes, even though on some roads it might actually be more appropriate to alter design standards to slow motor vehicle speeds. Similarly, in Indonesia, most city traffic improvement plans aim to increase vehicle speeds, rather than increasing vehicle speeds on long distance corridors and reduce them on residential and commercial corridors.

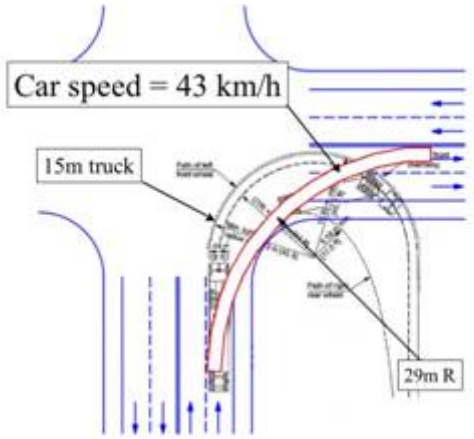
This problem is also embedded into the cost benefit analysis process. The cost benefit

Effective Turning Radius

It is common for roadway designers to use corner radii as a proxy for turning radii. The problem with this practice is that the two may not be equal, and often the turning radius is larger. It is better to use the 'effective turning radius – the widest possible turn that a driver can make. The left image below demonstrates the difference between the two.

Using the effective radius becomes important when determining the speed at which a driver can turn. In the right image below, the intersection is just large enough for 15m truck to turn the corner at minimal speed. The effective radius is 29m, which allows a car to turn at 43 km/h. At this speed a pedestrian struck would have a 1/3 chance of death and 2/3 chance of severe injury.





analysis done for the Surabaya Integrated Transport Network Project, which was funded by the World Bank, calculated economic benefits based solely on increased vehicle speeds even on roads where speed limits had not been defined and the appropriateness of the speed limits to the road's function had not been determined.
Settling the conflicting design needs of safety and convenience for non-motorised traffic and the safety and convenience of motorised traffic can best be settled through a careful definition of a functional road hierarchy, establishing appropriate speed limits, and designing roads in a manner appropriate to the road's use. Simply designing all roads for high speed motor vehicle use will destroy the commercial, recreational, and residential character of entire sections of the city.

Before improvements were made to an intersection in Saratoga Springs, NY, USA.

New York State Department of Transportation

After: The median on the far side is wider to reinforce the left turn lane. Note the bollards to protect pedestrians. Reid Ewing

7.6. Summary

Roadway design standards and design manuals in the past rarely focused on safe and convenient travel by non-motorised means. As such, these design standards played a role in creating unsafe conditions for non-motorised travel, and the resulting decline in the mode share of non-motorised transport.
Recent design manuals developed in the US, Holland, and other developed countries are starting to change this situation. They have not been developed for use in developing countries. However, there is a growing experience in the transformation of expertise from the north to the local context in the south. The quality requirements for cycling developed in the Netherlands, and the practices to balance the needs of different modes of transport, have found applications in developing countries. In developing countries, the trend is to put people first before cars. This leads to a different prioritization, which inevitably will restrict the free movement that cars have been given (without making destinations inaccessible for cars). Only in Western Europe principles have been implemented for traffic circulation and road design that give priority to pedestrians and cyclists. Transfer of this expertise is in progress.
The transformation will be a long lasting process. Engineers have been educated with a strong bias for cars. Given this situation, assigning clear administrative responsibility for the design and development of non-motorised transport facilities, the process by which non-motorised transport facilities are designed, and the involvement of non-motorised road users in the design process, are of critical importance.
Ultimately, new design standards should be developed which clearly link road speed limits and road designs to the road's function.

7.7. Review questions

1. How have roadway design standards contributed to the decline of safe non-motorised travel?

2. How can roadway design standards for safe non-motorised travel best be developed in a developing country context?
3. What roadway design standards are currently used in your country or municipality? What status do they have, legally and institutionally? How flexible are they? On what are they based? How might they be changed to better integrate design standards to roadway function?

8. Planning for non-motorised transport

8.1. Integrating non-motorised transport into transport master plans

If a city develops a transportation master plan, it is a good idea to integrate the concerns of non-motorised transport and the development of cycling networks directly into this master planning process. In many cities in Europe and in developing countries master plans are widely used. These plans sometimes enjoy the status of a law passed by national and local governments, and any new developments have to be in compliance with these plans, or else the plan has to be modified through a complex decision-making process. In China, master plans are very powerful but they are also secret, and it is virtually impossible for citizens groups or international agencies to directly affect them. Where master planning is an important part of the infrastructure development process, it is important to ensure that efforts to develop plans to improve non-motorised travel are integrated into these master plans. Otherwise, there is a significant risk that major infrastructure projects will be planned and designed with no attention to their impact on non-motorised travel, and no budget will be made available for the implementation of non-motorised transportation infrastructure.

Bogotá, Colombia 's 2000 Master Plan carefully integrated its pedestrian and cycling facilities into its overall transportation plans. Bogotá's 10-year Master Plan for the first time stipulates as a matter of policy that priority be given to the pedestrian, and indicates the projects that will be built in the city in the short, mid and long term. This is further specified in transportation master plans. The 2000 Transportation Master Plan stipulates that all new highways and road facilities include grade-separated bicycle paths and sidewalks of specific dimensions. The design specifications are based on the ***Taller del Espacio Público***, a manual in which the design for bike paths and public space is established.

The City of Trenton (New Jersey, USA) has used their 2004 Transportation Master Plan to evaluate the Level of Service (LOS) for cyclists. Transportation professionals are rather familiar with level of service indices for motor vehicles and transit. Using the same type of measures for non-motorised transport is somewhat new. Not only for bicycles, but

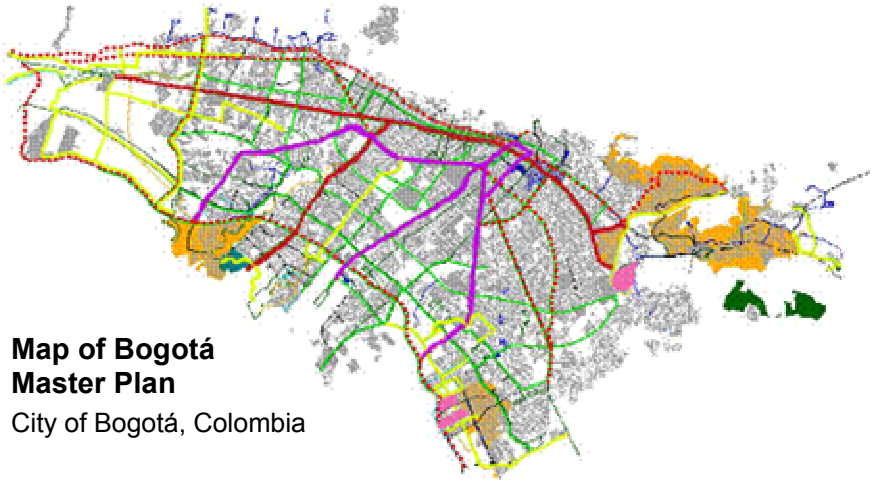
Optimising traffic systems in Asia

China and India are the countries where there is the most cycling and also where most cycles are manufactured. Yet investments in infrastructure largely ignore cyclists and pedestrians. Cyclists are banned from main roads in many cities. Constructing roads only for motorised traffic disregards the socio-economic reality that between 80 and 90% of all people walk, cycle or rely on public transport. A study conducted in Delhi revealed that this policy does not even promote the flow of motorised traffic.

The study noted that the expansion of roads is nearing breaking point. Therefore, the existing space must be used optimally. This requires separate facilities for pedestrians, cyclists and buses. These will be better able to handle bus and bicycle transport and produce 88% more capacity for movements by bus and 20-70% more movements by bicycle. It will also result in ' a 48% reduction in time costs due to 50% improvement in bus speeds, 30% improvement in the speeds of cars and two wheelers and 80% improvement over the present level of delays on a junction (where a flyover would cost 25 times more)'.
Additionally, the costs incurred through a lack of road safety will decrease by 46% and street side selling and other services for road users can be better regulated. The conclusion is "A well functioning road infrastructure must fulfil the requirements of all road users. If the infrastructure design does not meet these requirements all modes of transport will operate in sub-optimal conditions".

Geetam Tiwari TRIPP / IIT Delhi

LOS can be calculated for pedestrians and for delay to NMT traffic. At the least, balancing the LOS across modes begins to give equal weight to those modes.



Map of Bogotá Master Plan
City of Bogotá, Colombia

Some cities have developed independent cycling master plans to great effect. Cycling master planning can be used to develop a coherent vision for cycling and a strategy and timeline for implementing this vision. Normally cycling master plans include but are not limited to physical infrastructure. They generally lay out a broader strategy for promoting and improving conditions for cyclists, such as reviewing the impact of existing traffic laws and regulations on the rights and safety of cyclists and pedestrians. They can also include a review of other transportation infrastructure projects going forward and can suggest modifications. Where political will to improve conditions for cycling or walking is weak, a cycling master plan can be developed by advocacy groups as a way of promoting an alternative vision of what a city could do. The process of developing the cycling master plan itself can be a valuable tool for bringing together decision makers and stakeholders and developing a common vision for the future. Sometimes the cycling master plan will stipulate design standards. In the Netherlands a national Bicycle Master Plan was passed which made the promotion of bicycle use a clear policy of the Dutch Ministry of Transport. As a result, many cities then developed specific bicycle master plans. One of the first and most famous was developed by the City of Delft, much of which was implemented.

In other developing countries, and in the United States, transportation master plans either don't exist, or they are merely indicative, enjoying no legal status. Their political importance varies from total irrelevance to highly inspirational. Where master planning is not the general practice, while it would certainly do no harm to develop

Map of Bicycle Level of Service, Trenton, NJ, USA

Trenton Transportation Master Plan, Nelson/Nygard Consulting, 2004

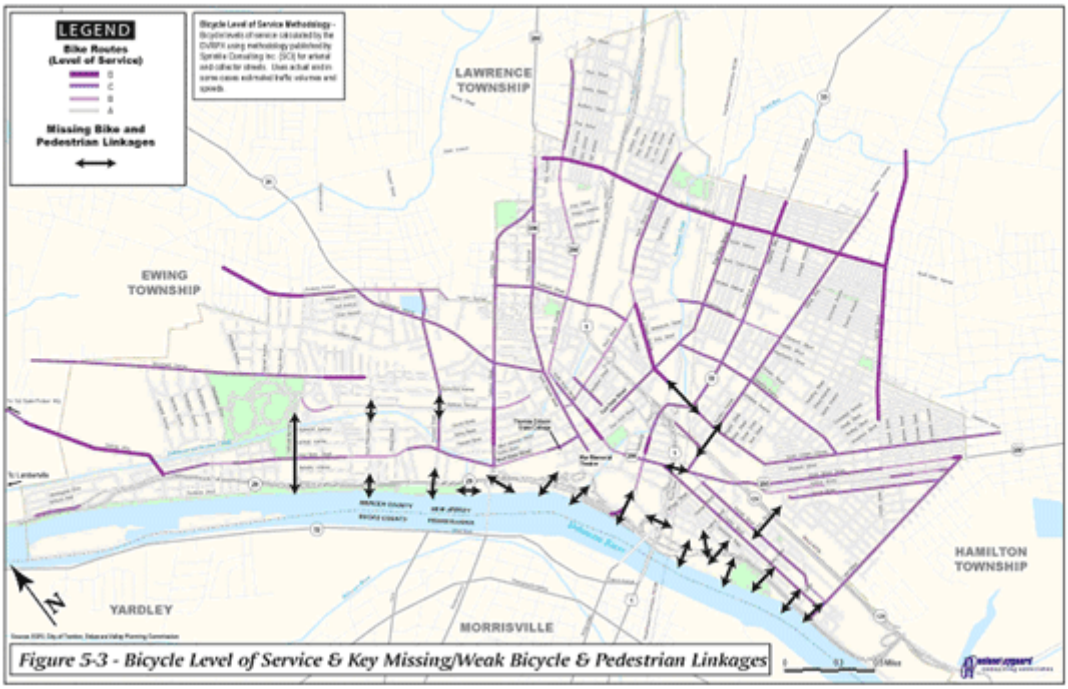


Figure 5-3 - Bicycle Level of Service & Key Missing/Weak Bicycle & Pedestrian Linkages

a cycling master plan, it may also not do much good. In this case, it may be more important to focus on ensuring that those transportation projects that are moving forward include provisions for non-motorised transport, or generating political interest in a high profile pedestrianization or bicycle facility in a prominent location such as along a waterfront.

The most important consideration when deciding what sort of planning to do is political relevance. If a municipality is currently not interested in non-motorised transport, the aim of a non-motorised transportation master plan should be to raise the level of political interest in the issue, by highlighting the number of fatalities of vulnerable road users, the impediments to low cost non-motorised travel, the additional air pollution generated as a result, etc. If the municipality is already committed to improving conditions for non-motorised travel, a more technical and detailed plan of action should be developed.

This information is derived from the Locomotives program, coordinated by I-ce Interface for Cycling Expertise in the Netherlands (www.i-ce.info)

8.2. Project team and task force formation

Whether integrating non-motorised transport into a transportation master plan, developing a cycling master plan, or incorporating non-motorised travel concerns into a major transport project, a **project team** must be selected. The project team could be a special administrative unit under the Mayor or city planning agency, or it could be contracted out to a private consulting firm. The project team is the group responsible for doing the actual planning and design work. **Ideally, the team leader should be someone who is a transportation planner and someone who is also a regular cyclist.** Normally this team should initially consist of a planner, a civil engineer, a person with political influence (could be a government agency, the Mayor's office, a retired senior planner now with an NGO, or the local staff of a development organisation), a local NGO with some involvement with cyclists or cycle rickshaw drivers, and someone with experience in surveying and GIS.

The project team will work for the project's sponsors, but one of its first tasks is to review governmental responsibility for non-motorised transport in the project city, and the responsible persons within each relevant government agency. These responsible persons should be invited to join a **Non-Motorised Transport Task Force or Committee**, which in turn might select a Chairman of this Committee responsible for inter-agency coordination. This Task Force is not responsible for doing the planning but for making decisions. This Committee should be chaired by the Mayor or a senior representative of the Mayor, and should involve all the relevant government agencies such as municipal planning agencies, public works, police, traffic management, and any

Bicycle parking in front of a train station, Leiden, The Netherlands

Lloyd Wright (taken from GTZ Photo CD 3)

One of Bogotá's newly built cycle ways

Karl Fjellstrom (taken from the GTZ Photo CD 4)

relevant public authorities, but it should also include some key stakeholders such as cycle rickshaw union representatives and other potential stakeholders. Formation of this Task Force early in the planning process can avoid obstacles to implementation in later phases.

This Task Force will be responsible for hosting public hearings when more developed plans are completed, for overseeing the proper implementation of the plans, and for acting as an advocate for the plans within the administration.

8.3. Selection of area to be improved

The Mayor or the NMT Task Force will have to decide on the scope and location of the project. The planning methodology will differ depending on whether it is a **neighbourhood-specific pilot project** or a **city-wide master plan** that is being developed.

For pilot projects, there are several factors to consider. A pilot location should have:

1. A high level of political commitment to NMT improvements by the district or ward (most local level) government. A city-wide project should be considered if it has the backing of the mayor.
2. A high level of support for NMT improvements in the community.
3. A high level of existing NMT traffic in the community.
4. A high level of potential NMT traffic in the community.
5. A high number of traffic accidents involving vulnerable road users.

In our experience, certain types of facilities tend to generate a large number of non-motorised trips. Among them are:

1. Schools and universities
2. Popular markets and shopping centres
3. Factories and other employers of large numbers of people who do not have access to motor vehicles
4. Houses of worship (they are visited frequently).

For this reason, some municipal programs in Europe and the US focus specifically on school access, and are known as '**Safe Routes to Schools**' program (further discussed below). For cycle rickshaws, the vast majority of trips are to schools, public transit stations, popular markets, and tourist locations. Programs can also focus only on such locations. This will greatly simplify the planning and prioritisation process.

8.4. Review questions

1. Given the status of transportation master plans and transportation planning in your municipality, devise a brief strategy for building political commitment for improved non-motorised transport facilities. What scope would be most appropriate?

9. Data collection for and monitoring of non-motorised transport improvement

9.1. Overview

The collection of data on existing conditions for non-motorised travel is not only important for developing good non-motorised facilities, it is also an important part of the process of educating decision-makers. Frequently, little or no data is actually collected about non-motorised travel. Household surveys and traffic counts may not even collect information about cycling or walking trips, or bicycle ownership, or it may collect the data but not report it. A large number of transport professionals in developing countries are completely unaware that people travel by non-motorised means, or have never paid any attention to it, and lack even basic information about it. Simply demonstrating that 30% of the trips on a given road are made by pedestrians and cyclists, or that 60% of the victims of traffic accidents are non-motorised road users, can help to sensitise policy makers and the public to the importance of the measures that later stages will propose. Also counting the number of short trips can provide an important indicator for the (potential) role of cycling.

However, the collection of data should not become an obstacle to the implementation of better pedestrian and cycling facilities. A single planner or a cycling club with a lot of cycling experience can probably identify quite quickly those major bottlenecks in desirable cycling routes without extensive analysis.

9.2. Review of existing institutional structures and NMT regulations

Any major NMT plan should begin with a review of which administrative units inside the municipality or higher levels of government have responsibility and budgetary control over sidewalks, roadside parking, roads, and cycling facility design, construction, and the regulation of activity on the sidewalks and roads. This may be extremely confusing and it may well be that nobody really knows who is responsible. Parking may be controlled by local mafias, and be completely out of the hands of the local government. Sidewalks, local streets, and parking may be under the control of a sub-municipal government, or a municipal department of parks and recreation. Planning of these facilities may be under the city planning office, public works, department of transportation, or even the police. The design of street furniture, telephone booths, bus stops, pedestrian overpasses, all of which could destroy the pedestrian environment, may be under the administrative control of a half dozen public authorities, or a department of town planning and architecture may retain firm control over all sidewalk-level design and activity.

A review of existing regulations governing NMT is also important. Design standards may already exist. Non-motorised vehicles may already be banned on specific streets, the police may forbid them despite the absence of any formal ban, or the police might allow them even if they are banned. Any existing road classification system or road hierarchy with associated allowable maximum speeds must be documented.

9.3. Assemble data on existing non-motorised travel

Assembling data about non-motorised travel is no different from assembling data about motorised travel, except that the scale of analysis particularly for pedestrians is frequently much smaller, which requires some additional information. How much data you can collect will be a function of how much money you can spend and how much time you have before final designs need to be completed for political reasons. More information is always better, but lack of information should never be an excuse not to improve conditions for non-motorised travel when many of the design remedies are fairly standard and self evident.

It is often useful to know how many people currently own bicycles, how many are currently cycling and walking, where they are

going on their bicycles, and where they would go if they could do it safely.

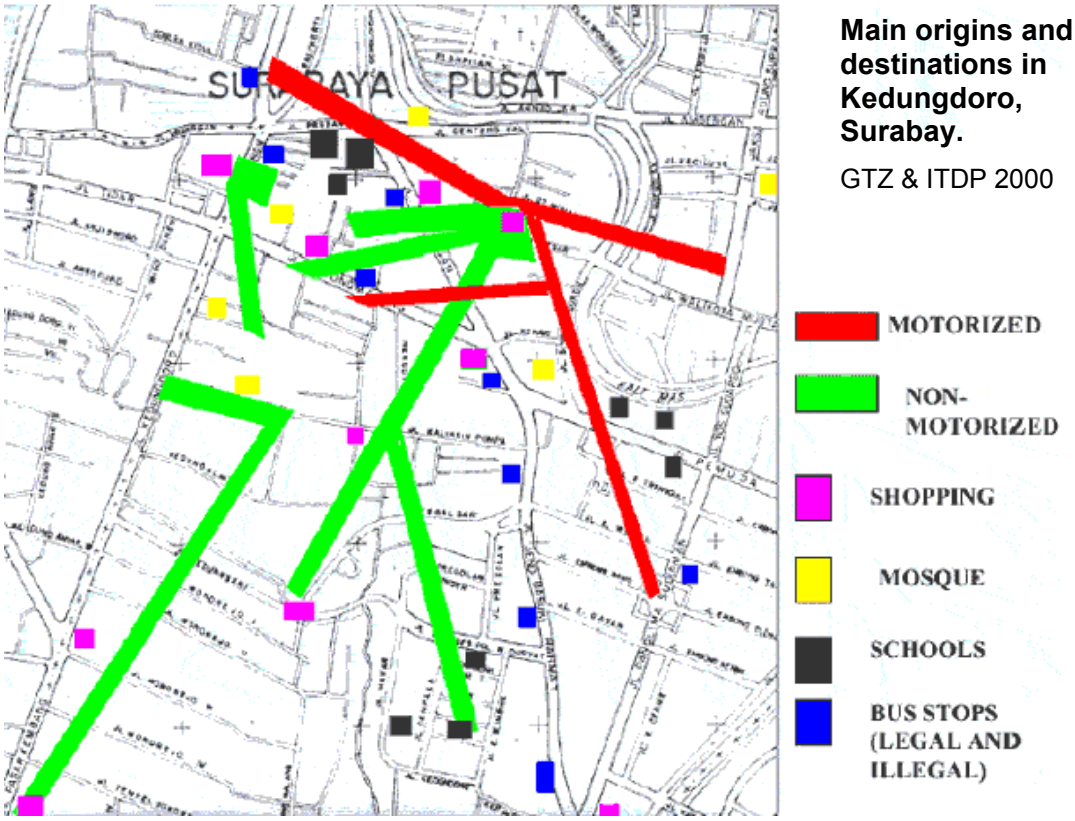
Origin and destination mapping

While origin and destination mapping for pedestrian trips is probably not necessary, it is useful for cycling and other non-motorised vehicle trips. Good places to start collecting this information are any existing household travel surveys or origin and destination surveys. Origin and destination surveys for an entire city are expensive and unlikely to be done just for the purposes of developing a cycling plan, but many cities have already conducted household surveys or origin and destination surveys, and even if they are old they will still give an indication of basic travel patterns and trip lengths.

Even if household surveys do not have any information about bicycle and walking trips, and about bicycle and motorcycle ownership levels, some additional spot surveying can be done to try and correct the original data. More intensive surveying might be done in areas of different income levels, and in areas with different NMV-friendliness factors, and assumptions made about other areas of similar income and type. Origin and destination data should be coded to correspond to pre-defined zones of roughly 250 sq. metres, (existing census zones or other zoning system used for other household survey data is best if the zones are small enough) and should also identify specific origins and destinations (ie. home address to the supermarket, or the local green market). Information on all trips of all family members must be collected, including trips by women and children. Trips by public transport should be broken into a trip to the bus stop and the bus trip.

Most important for non-motorised transport planning is controlling trip origins and destinations by trip length. Most non-motorised vehicle trips are comparatively short. Sometimes the vast majority of trips in a city are very short, and would easily be made by non-motorised means if safe facilities existed.

Facilities for non-motorised vehicles should be prioritized on higher speed roads with high concentrations of short trips. A map identifying significant concentrations of origin - destination (OD) pairs by different trip



Main origins and destinations in Kedungdoro, Surabay.

GTZ & ITDP 2000

distance ranges, focusing on trips in the 2 to 8 kilometre range, can be mapped. For longer distance trips it is reasonable to assume they are rarely going to be made by non-motorised means. All heavy concentrations of OD pairs currently made by bicycle, walking, or other non-motorised mode can be coloured in green. All concentrations of short distance OD pairs made by public transit can be coloured in yellow. All concentrations of short distance OD pairs currently made by motorcycle or other private motor vehicle can be mapped in red. The green colour coded mapping shows those routes where existing NMT trips would most benefit from improved infrastructure, and those red colour coded lines give a good indication of those trips which could most easily be shifted from motorised to non-motorised trips with improved facilities. It is also useful to locate on this map major specific trip attractors such as popular markets and schools and draw the OD pair lines to these points.

Such a model can be used then to calculate the potential modal shift impact of various non-motorised facility interventions. From this modal shift data, potential emissions reductions and fuel savings can be calculated.

Roadside surveys and traffic counts

Most cities have done some sort of traffic counts, and where they have not been done, it is fairly inexpensive to do them. Sometimes these counts include bicycles and cycle rickshaws, and sometimes they don't, and sometimes they lump bicycles and cycle rickshaws in with motorcycles or other vehicles. Having reasonably good data on the level of existing non-motorised vehicle use on higher speed corridors which connect a reasonably large number of shorter origin destination pairs is useful not only for documenting existing bicycle trips, but also because if volumes of two and three wheelers are high enough the design of facilities will need to take this into account.

It is better to simultaneously collect information about motor vehicle trips in the same location to get an accurate estimate of the modal split along specific roads at a given base year. Peak hours and midday counts are probably sufficient but full day counts would be ideal. Information about how many people are crossing these main road links by each mode during the same time period is also useful. Ideally this data can be collected for all roads leading into the Central Business Disctrict, or in a 'cordon' (all bridges over a river bisecting the city for example).

If a pilot NMT project is focusing on a specific location (rather than city-wide), and household survey data is only being collected from a few neighborhoods, or not at all, it will be important to compliment this data with origin and destination data collected on the roadside to capture those trips originating and ending outside the study area. These interviews will be much simpler than the household survey, consisting only of origin and destination surveys.

For more, see Introduction to Traffic Engineering: ***A Manual for Data Collection and Analysis***, Institute of Transportation Engineers, 2001 and ***Traffic Engineering Practices in Developing Countries***, Institute of Transportation Engineers, 1984. www.ite.org

9.4. Review and compile information on major transportation infrastructure projects underway

It is very likely that as you prepare your NMT plans with one branch of the government (say the city planning office), other agencies are simultaneously working on the exact same corridors with proposals radically different from your team with different government and international partners. The piece of land you are proposing for the major new north-south bikeway may have already been redesigned to be a high speed motorway under a World Bank loan, and the contract may already be signed with the contractors. The same corridor may be considered for a Metro with a national ministry, for a Monorail with the Governor or the Mayor, and for a shopping mall by a real estate developer. Lack of administrative coordination on urban development projects tends to be the rule rather than the exception.

Information is power, and the more information your team has on what is going on around the city, the more powerful your team will become, and the greater the chances your project will be implemented.

9.5. Analyze the quality of existing facilities for non-motorised travel

Whatever type of project you decide to plan, it will be useful to collect extensive data on existing facilities for non-motorised travel. Often a good place to start is a simple mapping of existing bicycle and pedestrian facilities and their quality or 'level of service' in the project area. Unlike with roads, where a relatively small number of variables determine the grade of the road (congestion, width, sight distance, curve ratios, etc), a fairly large number of factors contribute to a desirable walking and cycling environment. The presence or absence of sidewalks, whether the facilities are wide enough for the existing volume of non-motorised traffic (level of service), the presence or absence of shade trees, speed limits, the gradient of hills, architectural design factors, and other factors all contribute. For this reason, it is fairly typical to start with mapping based on fairly simple criteria, such as:

- red : very dangerous and uncomfortable or unusable
- yellow : somewhat dangerous and uncomfortable, and
- green : adequate.

More levels of quality are sometimes defined and color coded. For example, a street with a shaded bike lane or wide paved shoulder and relatively low vehicle operating speeds would be green, and a high-speed road with no shade, no shoulder, and no bike lane, would be red. In the case of many developing country cities, it is highly likely that all major arterials would be coded red, rendering this exercise un-necessary. Similar mapping may be done for pedestrian facilities (see below). Similar codes can be developed for crossing facilities. These maps can be useful tools to planning

This sidewalk in Kuala Lumpur is quite narrow for the pedestrian volumes, and is slippery when wet

Karl Fjellstrom (taken from the GTZ Photo CD 1)

departments for prioritising NMT facility improvements.

Walking and cycling audits are a community involvement tool that seek to quantify the walking and cycling environment to establish a baseline and advocate change. In many parts of the world the pedestrian infrastructure is poor, yet often officials are not aware of its condition. Walking audits can rectify this disparity. See the Parternship for a Walkable America's walking checklist, the US-based National Center for Bicycling & Walking's indicators worksheet, Anne Vernez Moudon's audit, and the Victoria Transport Institute's evaluation techniques for more information. (all these documents are available on the supporting documentation CD-ROM)

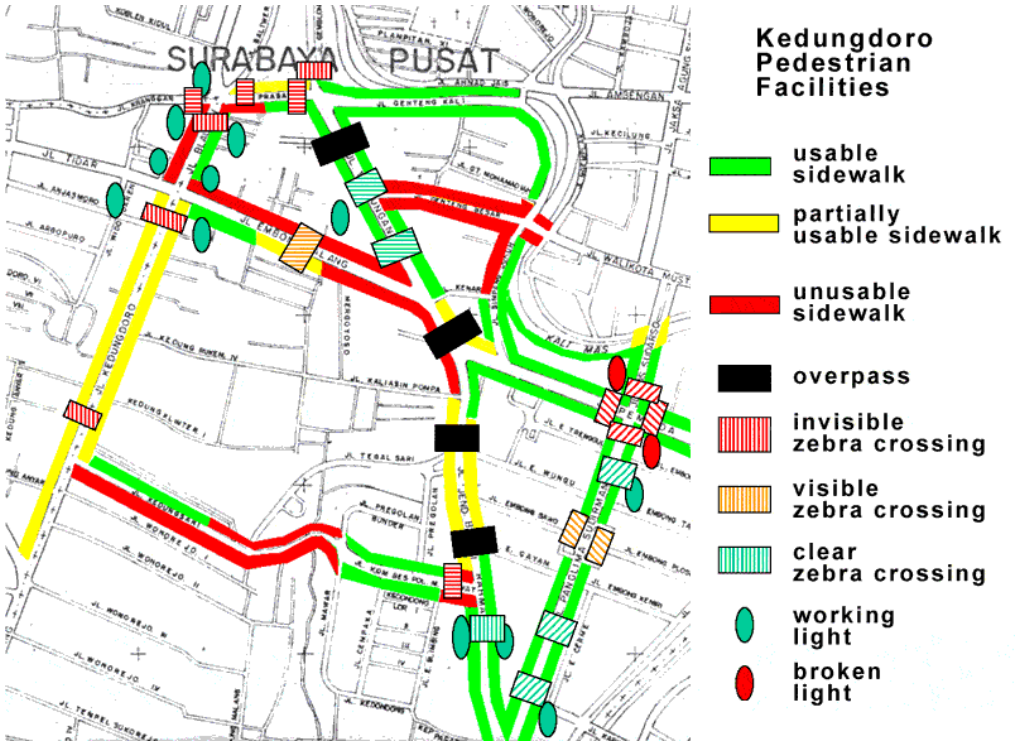
9.6. Documenting sidewalk conditions

Roadway departments regularly document the condition of pavement, curbs and other roadway features for maintenance and quality control purposes. The same methodology can be applied to sidewalks and other NMT routes. All one needs is a good map, a camera and a measuring wheel. In the image from Surabaya, sidewalks and crosswalks have been rated usable (green), partially usable (yellow) and unusable (red).

To get this information one walks the route and photographs at periodic intervals – say every 30m or as the conditions change.

Example for a mapping of perceived quality of NMV travel Pusat, Surabaya

GTZ & ITDP 2000

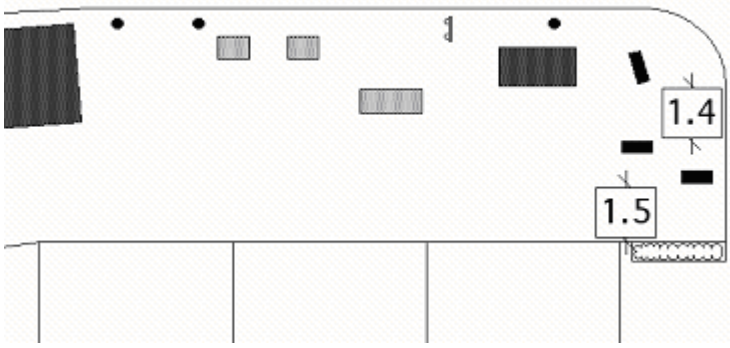


On the supporting CD-ROM for this course, you will find a movie, filmed in Capetown, which contains a series of slides taken between a large hotel and the nearest bus stop. This is the route walked everyday by much of the hotel staff. The varying conditions are clearly apparent, from well groomed sidewalks and good wheelchair ramps to trees blocking the path and poles blocking the crosswalk.

Taking the exercise a step further, one measures the sidewalk and notes each obstruction and the remaining width. The adjacent plan shows a sidewalk in Bangkok, Thailand . The sidewalk itself is about 5m wide, but the many obstructions (signs, utility boxes, bus stands, telephone booths, stairways, poles) reduce the 'effective' width to, in this case 1.4m and 1.5m.

Siam Square sidewalk layout, Bangkok , Thailand

Bangkok Metropolitan Authority



The notion of 'effective' width is one that is very important for sidewalk usability. In the two images below, the sidewalk on the left has a clear path in which to walk down the center of the walkway. The sidewalk on the right has its width compromised by trees and steps. There is only about 0.5m clear in which to walk.

Calculating Level of Service

The next step would be to calculate the level of service (LOS). Sidewalk LOS requires two inputs: effective width and number of pedestrians per hour. The chart below shows the range of area needed per person in the average and 'platoon' condition. Platoons are created when a group of pedestrians are released en masse by crosswalk signals, Metro doors or other temporal displacements. A platoon of walkers require more space than if the same number of people were spaced evenly throughout a sidewalk. When two platoons meet each other, as in a crosswalk, the spatial requirements are even greater.

For sidewalks in the Siam Square area in Bangkok, Thailand, the Bangkok

Metropolitan Authority surveyed the number of pedestrians per hour, and the sidewalks on which they walked. The following three charts show the results. The first shows absolute numbers for three sidewalk segments. In the second the LOS is calculated for the average and platoon conditions. Both weekday and weekend pedestrian counts were used, much like different peak hours are used in (poles, stairways, phone booths, taxi stands, signs) be removed. This was done to demonstrate that by simply removing or reorganizing the street furniture, one can create a clear path, greater 'effective' width and a higher LOS.

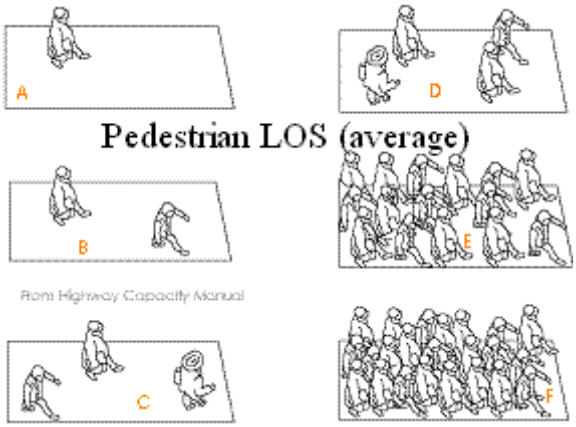
Walkway Level of Service (m² per person) and graphic depiction

Highway Capacity Manual, 2000

Walkway LOS

	Average	Platoon
A	> 5.6	> 49.2
B	> 3.7 - 5.6	> 8.4 - 49.2
C	> 2.2 - 3.7	> 3.7 - 8.4
D	> 1.4 - 2.2	> 2.1 - 3.7
E	> 0.7 - 1.4	> 1.0 - 2.1
F	<= 0.7	<= 1.0

square meters per person



LOS w/ no obstructions

		Average	Platoon
Phaya Thai & Soi Chula 64	weekday	A	B
	weekend	B	D
Rama I & Soi 3	weekday	A	B
	weekend	A	C
Rama I & Soi 6	weekday	A	A
	weekend	A	B

Sidewalk LOS Measurements

	W	W*		Pk Vol
Phaya Thai & Soi Chula 64	3.8m	0.4m	weekday	1299
			weekend	3360
Rama I & Soi 3	5.9m	1.1m	weekday	1647
			weekend	4692
Rama I & Soi 6	8.2m	1.3m	weekday	345
			weekend	918

Primary arterials in Bangkok and Surabaya (top left)

Michael King & GTZ

Siam Square Sidewalk LOS

		Average	Platoon
Phaya Thai & Soi Chula 64	weekday	D	F
	weekend	F	F
Rama I & Soi 3	weekday	C	D
	weekend	E	F
Rama I & Soi 6	weekday	A	A
	weekend	A	C

Left photo: Princeton NJ , USA

Right photo: St Louis MO , USA

Michael King

9.7. Analyze the safety conditions for non-motorised travel

A fundamental first step in identifying unsafe roadway and intersection designs is to map where pedestrians and other vulnerable road users are currently being injured or killed by motor vehicles.

Most police departments collect at least some information about the location, time, and basic events of severe road traffic accidents. In developing countries, it is surprising how rarely this information is actually used for roadway design. While this police information is often flawed, and planners should be aware of the ways in which it is flawed, it is still an extremely important source of information.

First, collect traffic accident (crash) data for incidents involving non-motorised road users from the police and map the locations as precisely as possible. A division between intersection and non-intersection accidents is required. Even though the numbers are likely to be significantly undercounted, this simple mapping exercise should make it possible to identify particularly dangerous locations. To the extent possible, this effort should be grounded in overall road safety efforts (see also *Module 5b: Urban Road Safety*), which may be non-existent or may propose remedies hostile to vulnerable road users.

To analyze accidents properly, information is also needed on the people involved in the accident, (were they old or young, walking or driving, etc), the time and date of the accident, and the precise location of the accident. The more complete and detailed the data collected, the better the analysis can be.

In the example below the pedestrian volumes along the bus rapid transit corridor in Jakarta were compared to injury locations. This comparison was used to demonstrate that where there are higher pedestrian volumes, there are not necessarily more deaths and severe injuries. In fact it has been shown that vehicle speed is a better indicator of injury severity. Pedestrian volumes usually mean more absolute numbers getting hit, but generally with less severe outcomes. This is the 'Safety in Numbers' argument that is gaining currency within pedestrian safety circles.

Mapping of traffic accidents

Pedestrian Accidents, Community District 2, Brooklyn, April 1989 to March 1994. Mapping of incidence of accidents at intersections is more relevant in cities where the majority of accidents occur at intersections. In developing countries, far more accidents occur between intersections, which requires more detailed mapping.

Michael King

In the second set of adjacent maps, absolute numbers of pedestrians hit by vehicles are shown on the left. On the right those same incidents are shown compared to pedestrian volumes. This shows that where there are a lot of pedestrians there may be more incidents, but as a proportion they might be less than where there are fewer people walking.

In any type of statistical analysis one should always be aware of the difference between absolute and proportional numbers. For example, the number of children hit by cars may have fallen from one year to the next, but if fewer children are walking, then it may be proportionally more dangerous. Accidents (crashes) are generally coded by the police in terms of the result, from a death to a fender bender. The chart below lists factors which can be used to determine the relative safety of a location or area. This type of analysis is most useful for traffic calming, where the incidents of property damage may increase, but the

Crash Cost Factors in the USA

Factor	Severity
1300	Fatality
90	Incapacitating injury
18	Evident injury
10	Possible injury
1	Property damage only

M Homberger, et al. Fundamentals of Traffic Engineering,

Pedestrian Volumes along Bus Rapid Transit Corridor, Jakarta, Indonesia

ITDP

Pedestrian Injuries and Deaths along Bus Rapid Transit Corridor, Jakarta, Indonesia

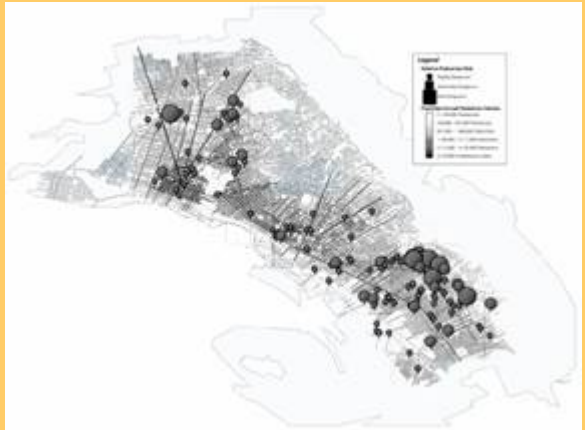
ITDP

Absolute number of pedestrian injuries, Oakland CA, USA

U.C. Berkeley Traffic Safety Center

Pedestrian injuries divided by pedestrian volumes, Oakland CA, USA

U.C. Berkeley Traffic Safety Center



rate of hospitalization and deaths decreases.

Once this information is mapped, it is likely that specific locations will appear to be particularly dangerous. At this point, it is very important to **go and look at the location** and see what physical features might be causing the high accident rates (lack of sidewalks or pedestrian refuge islands, lack of street lighting, etc.). Only by looking at the specific location can **the cause or causes** of the accidents really be determined.

Once an intersection has been identified as dangerous through mapping of traffic accidents (as shown in the box) or based on the perceived danger of cycling groups, **a detailed mapping of likely conflicts at this intersection may be necessary**. These diagrams should indicate the location and type of design interventions that will be necessary.

Frequently, safety analysts will focus on one element of aggregate road safety data and draw the wrong conclusions. For example, in some countries, overall statistics often show that a large percentage of pedestrians killed in traffic accidents had been drinking, or that a large percentage were 5 to 9 year old boys.

Without careful analysis of the location, however, it would be wrong to conclude that drunkenness among pedestrians or unruly childish behavior was the cause of the accidents. It may be that most of the accidents are concentrated at a few intersections. A detailed analysis of the accidents at a specific intersection might show that the percentage of victims with elevated blood alcohol content is precisely the same as the percentage of the general population with elevated levels of blood alcohol. As such, the safety problem in this case would lie with unsafe roadway design rather than with the behavior of pedestrians.

There are also some well known problems with typical police data, and analysts need to be aware of these limitations. Vehicle-vehicle incidents and incidents involving fatalities are typically reported with reasonable accuracy, but only 35 to 85 percent of vehicle-bicycle and vehicle-pedestrian incidents involving injury are included in typical crash statistics.

Conflict Analysis

Researchers at Lund University in Sweden have developed a 'conflict-analysis' technique where a location is observed and conflicts between various roadway users are observed and recorded. These 'conflicts' could be near misses, evasive maneuvers or simply a reduction in pace. The idea is that this type of information paints a more complete picture of the safety at a particular location than does accident statistics. It is especially useful where most traffic incidents go unreported. Application of the technique however demands training.

A short description can be found on the supporting documentation CD-ROM.

These estimates were developed by comparing accidents reported by police and hospital admission records.

A study of California children estimated that police reports only cover 80 percent of hospital admissions. A British study found that only 67 percent of slight injuries to pedestrians were reported while 85 percent of serious injuries were. In Germany the figures are 50 percent for major injury and 35 percent for minor. Based on this research, it is appropriate to adjust vehicle-bicycle and vehicle pedestrian injury statistics upwards by at least 50 percent.

This problem is even more acute in developing countries. It is typically the case that police are not really trained to properly record accident data usable for detailed safety analysis. Victims are also sometimes reluctant to involve the police unless an accident is of great seriousness, because they are afraid they may be blamed or arrested.

9.8. Monitoring NMT-Interventions

As one of the most important aspects of NMT planning, reliable monitoring of the situation before, of the intervention procedure and the impacts of measures taken is the key for developing NMT plans and policies.

Basing on a before/after-approach, monitoring should take place both (a) before and during the programming- and the implementation and (b) after the project. It should initially deliver a problem inventory (Situation before monitoring).

During the implementation phase it is important not only to monitor the actions taken but also to investigate the communication procedures between the different actors, and not least the results of the single interventions to compare with the objectives and to examine to what extent urban mobility conditions for non-motorised transport have improved – and if not, which obstacles hindered success of the intervention (Impact Monitoring).

The areas for investigation and evaluation are listed on the next page and include the respective criteria and variables to get quantitative and qualitative data.

Methods of data collection can be:

- Traffic counts
- Yearly statistical data (different sources)
- Standardised interviews with road user groups
- Open interviews with road user groups
- Noise- and emission-investigations
- Site observations (visits - notes)
- Mapping
- Photographic and Video site observations

At the end of the project an overall evaluation should take place, including description of direct and indirect changes (e.g. use of facilities, change in behaviour of different road users, economic side effects), cost-benefit analysis, a summary of results and experience, recommendations for comparable projects and presentation/publication material.

Table of areas for investigation and evaluation when monitoring a NMT intervention:

Area for investigation	Criteria	Key variables
Safety	Vehicle speed	Max. vehicle speed
	Traffic conflicts Traffic behaviour	Number of gradually differentiated cases of traffic conflicts – related to different road user
	Death rates	On arterial roads On other roads
	Accident rates	On arterial roads On other roads
	Traffic behaviour	Speeding Enforcement of rules
	Feeling of safety and security	Perception of road users
Mobility structure (directness, accessibility)	Traffic volume, road capacity, traffic composition (modal split)	Number of vehicles per hour, share of car, public transport, cycling and walking
	Continuity	Missing links
	Travel time	Per trip distance (gender!)
	Travel costs	Fuel prices, transit fares
	Detour distance	Actual distance / straight line distance
	Route quality	Constance of quality
	Route alternatives	Choice
	Route signing	Route easy to find
Comfort	Travel speed	Walking / cycling speed
	Traffic obstruction Stops (for cycling)	Obstructions per km Average stops per km
	Pavement smoothness	Type and quality of pavement
Attractiveness	Cleanness of tracks and lanes Shade Visibility at night Feeling of attractiveness	Dirty spots Trees, shaded tracks Functioning street lights Perception of users
Social Inclusion	Participation of women Participation of ethnic groups	In employment and welfare
Economy	Employment Productivity Bicycle market Welfare distribution	Formal , informal employment (transport sector / other sectors) Supply and demand for bicycles
Awareness	Presence in press	Regular publications

10. Identifying the NMT network

10.1. Indentifying the bicycle network

The information collected above should provide a fairly clear idea of where people are going and would like to go via non-motorised vehicles. At this point, it is important to identify a backbone network. The Dutch manual "Sign Up for the Bike" lists the following priorities for identifying parts of a bicycle network.

- **Safety**
  (the infrastructure guarantees the road safety of cyclists and other road users);
- **Comfort**
  (the infrastructure enables a quick and comfortable flow of bicycle traffic);
- **Attractiveness**
  (the infrastructure is designed and fitted in the surroundings in such a way that cycling is attractive and that cyclists can easily find their routes and destination);
- **Coherence**
  (the infrastructure forms a coherent unit and links with all departure points and destinations of cyclists);
- **Directness**
  (the infrastructure continually offers the cyclists as direct a route as possible)

One or two bicycle routes might please users but never induce a significant rise of bicycle use.
Even a carefully selected bicycle route will only provide a bicycle route for some of the urban journeys. Providing one single bikeway in an otherwise hostile cycling environment can be compared with the urban planner who designs a city with only one road. Of course, the cyclist can use the existing roads to get to (and from) the bicycle route, but when these roads are still dangerous and uncomfortable to cycle, the bicycle route will not attract new cyclists. Underneath some Dutch experience with this matter is summarised.

Pedestrianised area with bicycle access, Offenburg, Germany 2001
Klaus Banse (taken from GTZ Photo CD 3)

Some history of bicycle planning in the Netherlands

In the pioneering phase of bicycle planning (world-wide) in the Netherlands in the 70's and early 80's some nice pilots and studies have been done. In the cities of Tilburg and The Hague one high quality bicycle route (separate bikeways, 3 m wide or wider, 5-10 kms of length) have been built from the city-centre to the outskirts of the city. The effect was that the routes where heavily used, but did not attract new cyclists. The only result was that 'existing' cyclists changed their routes in such a way that they could use the new facilities.
The answer to this was a new pilot in the city of Delft in the 80's. Here a city-wide bicycle network consisting of three levels (urban network, district network, neighbourhood network) was constructed. The mesh-widths of the three networks vary from 100 m (neighbourhood network) to 500 – 800 m for the urban level network. The whole project was co-financed by the National ministry of Transport and accompanied by a series of before- (1982) and after- (1985) studies by several well-known institutes (TNO, Delft University of Technology and others). The most significant results of the studies were

that people changed their route choice to use the high-quality facilities of the city network and that, the already high level of bicycle use (about 40% of all trips) rose in the districts where the network was implemented compared to the control areas (where no such facilities had been built). In the study areas where the bicycle facilities were implemented, car used stabilised or dropped during the three-year period, while car-use increased in the control area. In a seven years period (1980-1987) the total distance covered by bicycle in Delft grew with 12% while the accident risk for cyclists (bicycle accidents per cycled kilometre) fell with 20%.

This section is drawn from the report of the Ministry of Transport and Public Works, Transport and Traffic Division, Evaluation of the Delft Bicycle Network Plan, Final Summary Report, The Hague, July 1987

"*It is important to stress that a network does not necessarily consists of bicycle tracks and bicycle-lanes everywhere. The most important thing is that comfortable, direct and safe cycling on the routes in the network is provided for. A street on which cyclists can safely cycle between the motorised traffic can also offer the desired circumstances.*" (from: ***Bicycle Network Report, Marikina Bikeways, I-ce, Interface for Cycling Expertise, 2001***).

Because bicycling and cycle rickshaw trips tend to be short and varied, at this point it is a good idea to **make many of the most popular short trips between the most popular origins and destinations using either a bicycle or cycle rickshaw, and assess in detail the quality of the journey.**

It is often useful to map all actual routes between each different major origin and destination pair in the project area. If there is a major trip attractor in the destination zone, (shopping centre, school, hospital), use this as the destination point. If not, use a central point in each zone. This can usually be done by asking someone on the Task Force or the Project Team familiar with bicycling and riding cycle rickshaws in the project area. If no one is familiar with the popular routes, the project team will have to travel these routes on their own.

On this map it would be useful to highlight any roads or streets where bicycle or cycle rickshaw use are strictly forbidden by regulation, pedestrian-only streets and other traffic restrictions.

This actual route mapping can be used to calculate detour factors. Detour factors are the most systematic way of identifying major severance problems. Severance problems can be created by unsafe, high-speed roads, by restrictions on non-motorised vehicles on specific streets, by barriers to crossing streets, by a one-way street system, and by large canals, railroad tracks, and other impassable infrastructure. Detour factors are the distance that the average cyclists or cycle rickshaw operator needs to travel out of their way in order to reach their destination, relative to the distance as the crow flies (straight line distance). In a typical European or American traffic grid with no restrictions on non-motorised vehicle travel, the detour factors are generally very low. A detour factor of 1.2, as observed in Delft, Holland, is extremely low. This means that the average cyclist only needs to travel 20% farther than a straight line distance in order to reach their destination. The mapping of some detour factors in Surabaya in chapter 1 indicates that Asian cities with many one-way streets, few intersections, a weak secondary and tertiary street system, and unsafe high speed roads can have fantastically high detour factors. These detour factors impose far fewer economic

The Delft cycling network, with a detour factor of 1.2
Interface for Cycling Expertise

Map of cyclist-friendly streets, Cambridge MA, USA

costs on motor vehicles traveling at high speeds than they do on non-motorised modes which travel at slow speeds. Nonetheless, they generate enormous unnecessary emissions, congestion and fuel consumption, and also discourage non-motorised travel.

When identifying necessary NMV improvements, reducing these detour factors is a key objective. It can be assumed that the modal split for non-motorised modes should be similar for similar trip distances. As the share of NMV trips increases the shorter the distance between OD pairs, shortening the actual OD pair trip distance should increase the number of NMV trips to those typical of that trip distance. Based on this, changed detour factors can be used to calculate potential fuel savings and CO2 and other emissions reductions from planned infrastructure changes that reduce detour factors.

10.2. Pedestrian route analysis

Pedestrian trips are generally sufficiently short that network analysis is not as important as simply providing good quality pedestrian facilities on all streets with any pedestrian traffic. However, pedestrian route analysis is popularly used for two purposes: detailed pedestrian facility designs at complex, dangerous intersections, and in 'Safe Routes to Schools' programs.

Pedestrian tracking surveys (see next page for details) are useful to document exactly how people use a street, intersection or plaza. These surveys have been used to redesign intersections, show how the space is used throughout the day, and demonstrate a specific pattern (such as a need for a crosswalk).

Maps and mapping techniques developed for **Safe Routes to School** (SR2S) programs are very useful for identifying walking patterns and directing improvements. The most successful safe routes to schools program directly involve parents and older students in the data collection process. Students and parents are provided with blank maps of the area and asked to simply draw their specific route to school, sidewalk by sidewalk (see example below). These maps can also indicate locations of perceived danger, and of potential high pedestrian level detour factors.

Again, when a specific intersection has been identified as being dangerous, planners can simply take a detailed map of the intersection and map over the course of a peak hour how people are actually crossing the street, and locations of conflict. This very localised data is helpful when designing pedestrian safety measures.

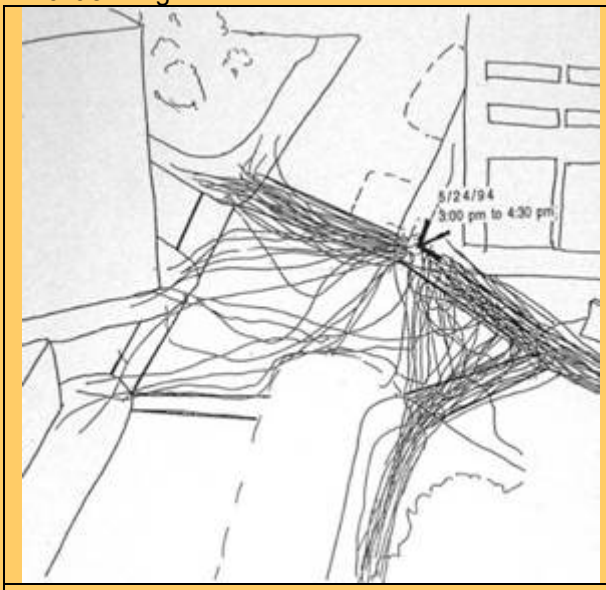
After changes to the street system have been completed, SR2S programs can then produce maps showing the safest way to school.

Tracking survey used as an inter-section redesign tool, Mulry Square, New York, USA
Project for Public Spaces

Pedestrian Tracking Surveys

The basic technique for tracking pedestrians is to position surveyors at the 'entries' of the location. [At a typical 4-leg intersection, there are eight sidewalks that lead to the intersection, hence eight points.] As people walk past, the surveyors record on a plan of the area exactly where they walked, where they crossed the street, where they turned around, etc. The surveyors do not actually follow anyone. The survey can last from 30 minutes to two hours, depending on how long it takes to establish the walking patterns. The surveys are then compiled into one composite map and distilled as necessary.

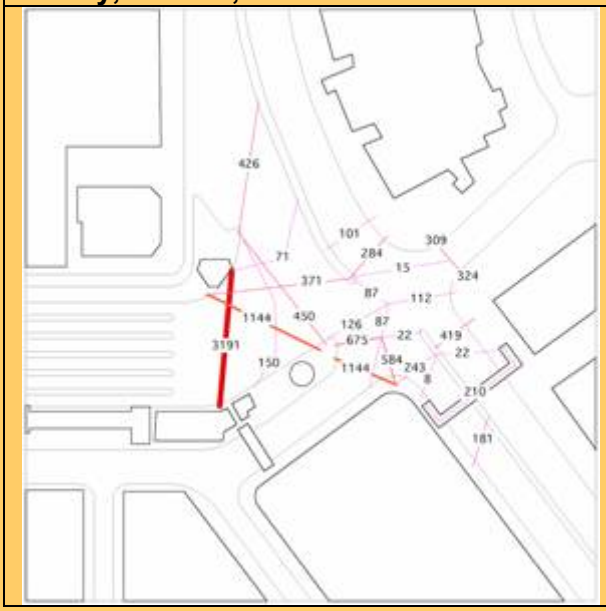
Michael King



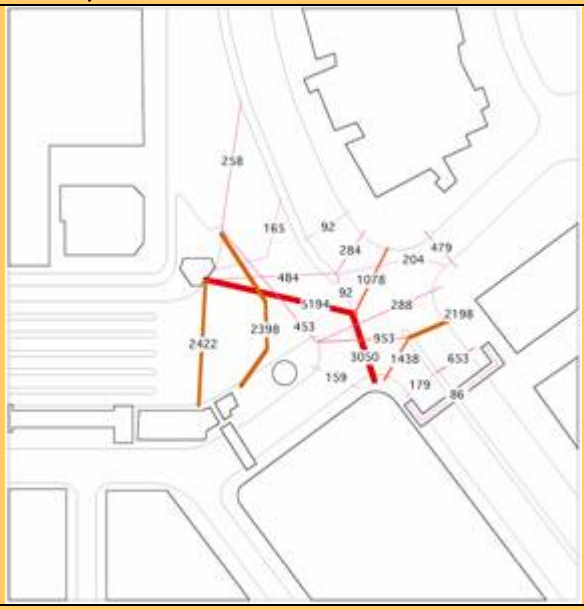
Abov: One sheet of a tracking survey, New York Project for Public Spaces

Above: Composite tracking survey – note there are 19 survey points, New York Michael King

Below: Morning peak hour tracking survey, Jakarta, Indonesia ITDP

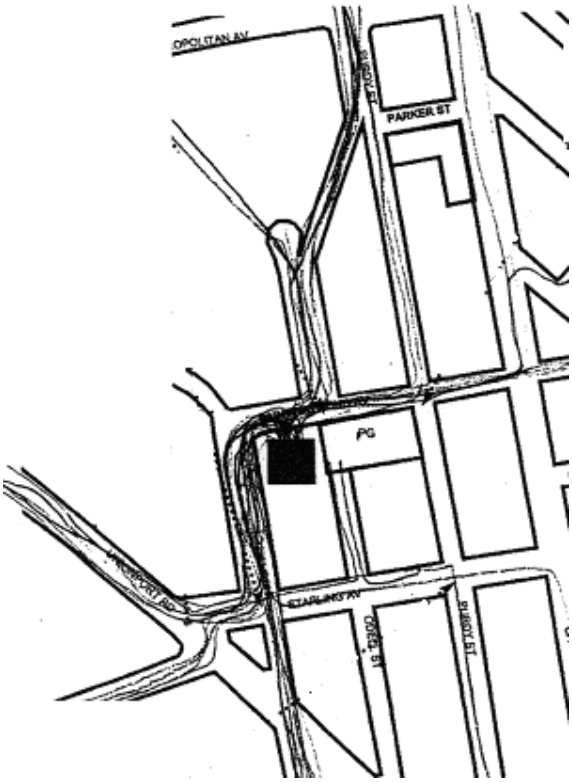


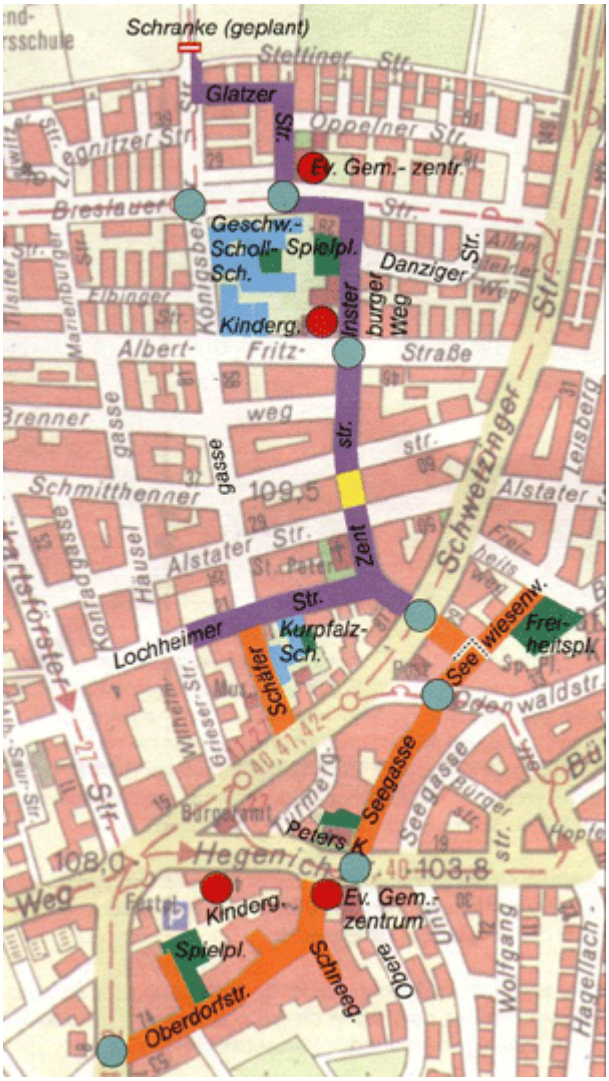
Below: Evening peak hour tracking survey, Jakarta, Indonesia ITDP



In the example below the schools are shown in light blue with the playgrounds and after-school centers in green. The connecting streets (shown in purple and orange) have been traffic calmed. For example, the yellow street has been closed to traffic, further limiting the conflict between walkers and drivers. Dangerous intersections (blue dots) have received specific interventions to make crossing them safe for children.
Having completed some or all of the above analysis, the project team should now be in a position to identify the priority locations requiring NMT improvements. These priority improvements can then be listed in a table and represented on a map. Only at this stage should the physical design process begin.

right: Michael King, Transportation Alternatives
below: SR2S map, Heidelberg-Kirchheim, Germany





10.3. Safety requirements for networks for cars and cyclists

(This sections was contributed by Roelof Wittink and draws from his article Planning for Cycling supports Road Safety. In: Sustainable Transport, Planning for Walking and Cycling in Urban Environments, ed. R. Tolley, Woodhead, UK, 2003)

In the framework of the Dutch Sustainable Road Safety System recommendations have been developed for a safe design of the road network, according to the three functional categories for flow traffic, the distribution of traffic and the access of destinations. The different demands of different modes of transport have been integrated.

The road network for cars

- Roads with a flow function for cars need to accommodate a relatively high speed. To prevent accidents while allowing for high speed, predictable behaviour is very much required. Because of the vulnerability of cyclists and pedestrians in relation to speeding, motorised traffic should be completely segregated from non-motorised traffic. Of course, these roads are not present in urban areas.

- In areas where people live or spend longer periods of time for other reasons, only roads with an access function for cars can be tolerated. The vast majority of urban roads in the Netherlands are going to be designed for only that purpose and have a speed limit of 30-km per hour. Urban areas are designed in a very varied way. To ensure safety, streets must be designed in a way to focus attention on the surroundings in order to take care of other road users and search for destinations. What must be removed is every design detail that caters for a flow function for traffic.
- Roads with a distribution function mark the transition between the two other categories. A limited number of these roads should free most of the urban areas from through traffic. These roads will have a speed limit of 50 km per hour (or, very few, 70 km per hour).

The road network for cycling

The network of main routes for cycling may traverse residential areas and other parts may be situated alongside roads, which have a connection function for cars, where segregated bicycle tracks or lanes are provided. Bicycle tracks will have a width of between 2 and 2.5 metres . Lanes are permitted when car volumes are below 6000 vehicles per day. Lanes will have a minimum width of 1.50 metres. At every crossing the right of way is arranged by signs and markings. Cyclists on segregated tracks share the right of way with cars.

The speed limits in residential areas allow cyclists to mix with cars, sharing the same space. In general there are no arrangements on right of way, meaning that traffic coming from the right, has the right of way. However cyclists on main cycling routes receive right of way over all crossing traffic.

10.4. Review questions

1. The mayor is interested in doing a “Safe Routes to Schools” program in one district. How should that district be selected?
2. A group of cycling enthusiasts have received some funding to develop a cycling master plan. Meanwhile, the World Bank is funding a transportation master plan, and a private consultant has been contracted. Their terms of reference include no mention of non-motorised travel. Discuss the benefits and drawbacks of collaboration with the World Bank consultants versus doing an independent cycling master plan.
3. The mayor wants to develop a backbone bicycling network. A household survey has been conducted five years ago that did not collect information on bicycle or walking trips, but can disaggregate the data by trip distance. How would you identify the basic cycling network, and what other information would you want to collect?
4. The mayor has decided to take a strong initiative to improve road safety. An analysis of traffic accidents in the city indicates that a large number of accidents are concentrated on two complicated intersections. What sort of analysis would you do to prepare a safer design for this intersection?

11. Designing appropriate NMT facilities

11.1. Overview of designing appropriate NMT facilities

There are three critical considerations when considering the design of non-motorised travel facilities. First, the roadway must be designed appropriate to the road's function. Secondly, the roadway should be designed to make travel comfortable, efficient and convenient for each type of user of the road. Finally, the roadway must be designed to accommodate the projected flow of vehicles on the road.

The proper functioning of an urban traffic system begins with proper street design. Walking trips are the most efficient for very short trips, because no time and no space is required to park the vehicle. Cycling trips are the most efficient for short to medium trips because bicycles can normally be parked close to the trip origin and trip destination because they take up limited parking space and can travel as fast as the speed limits on most local streets. For longer trips, buses and metros are more efficient for dense urban areas because they consume less road space, but people need to walk or cycle to the bus or metro line, then wait for the bus. In the Netherlands, 30% of all train passengers arrive by bicycle and more than 10% have a bicycle available when they leave the train for their final destination. For longer trips to low density areas, where congestion and the cost of land are less a concern, private motor vehicles are more efficient.

It is therefore critical that road design encourages people to use the most efficient mode of transport for the trip that they are taking. Cyclists also have some special concerns regardless of the type of road they are operating on. Cyclists are more sensitive to the smoothness of the roadway than motorists, and prefer smooth surfaces. Storm drains pose significant problems for cyclists if they are designed wide enough for bicycle wheels to fall into them. Steep open drainage ditches also present hazards for cyclists. Steep curb

Primary arterials in Bangkok (above) and Surabaya (below)

Top: Michael King, Bottom: GTZ

cuts are also more hazardous than rounded curb cuts. Cyclists are also as sensitive if not more sensitive to pot holes, cracks in the roadway, overgrown plants along the roadside, sand, gravel, and oil on the roadway, and other maintenance concerns that also affect motorists. Proper roadway maintenance is even more important on cycling facilities than on motorised vehicle facilities but too frequently ignored. The lack of proper maintenance and sub-standard design of cycling facilities has led some cyclists to conclude that separate cycling facilities are actually worse than having no special facilities at all.

11.2. Design based on roadway function

At the very local level in most developing country cities, within each neighborhood are a set of **local streets** that are short, narrow and discontinuous. These may be purely pedestrian zones, parking lots, or low speed streets. This is the pedestrian network. In many cities, particularly in developing countries, these

small secondary and tertiary streets do not form a complete network beyond the local neighborhood, and they stop at the first major arterial, drainage canal, or at the perimeter of a large private property. Some attention should be paid to **linking some of these secondary and tertiary arterials into more of a network by constructing additional cycling and walking bridges over canals, highways, and other barriers** to complete a local non-motorised travel network.

On these narrow roads, segregating pedestrian, cycling, and motorised modes is generally impossible and not necessary, as vehicular travel speeds are too slow to cause much danger.

Because these very local streets will often not form a complete network, however, and because many destinations such as shops, schools, and places of work, will front on the major arterials, pedestrians and cyclists will still sometimes have to rely on the main arterials. Road designs should therefore accommodate rather than discourage short distance non-motorised travel, and sidewalks or bike paths along the arterials will become part of a bicycling and walking network.

Pedestrian Network, Bangkok

Michael King

Mixed use secondary arterial, Bangkok

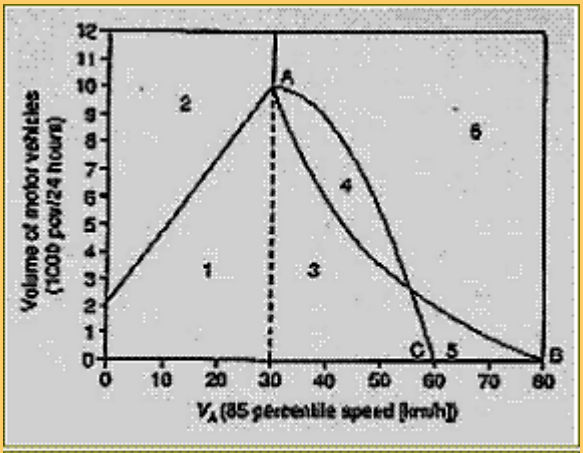
Michael King

Primary arterial with contra-flow bus lane and lots of commercial activity.

Michael King

Any roads which have a substantial share of both vehicle and pedestrian trips is part of a **mixed-use network**. These are normally **secondary arterials and some primary arterials**, streets which see their fair share of cars, trucks and busses, but also serve a lot of short distance trips. Crosswalks at the arterials can also be seen as part of this mixed-use network. This third network may represent the majority of roads in many cities, and is the most complex in terms of design. If priority in the first network is given to motorised vehicles, and priority in the second is given to people, priority is mixed in the third. It must be balanced both temporally and spatially to survive.

It is not unusual, particularly in developing countries where there is often a weak secondary and tertiary street network, for primary arterials to have a lot of commercial and residential activity, and to serve a lot of short trips. On the left photo below, this primary arterial in Bangkok also serves a lot of short distance trips between apartment buildings and the small shops. The dirt that has accumulated on the roadway indicates that a full lane of the road is not actually being used for through traffic. Rather, it is being used only for vehicle parking, truck deliveries, and pedestrians. As such, part of this roadway could be redesigned to more comfortably accommodate these short distance travel functions.



Graph for determining appropriate cycling facilities (from CROW, 1993, p.80)

Amount of separation between cyclists and motor vehicles with various speed-volume combinations. CROW Manual 1993

11.3. Design based on safety

When a pedestrian or cyclist is struck by a motor vehicle, the risk of serious injury is directly related to the speed of the impact. The chances of being killed increases dramatically over 40kph. As such, roads where the vehicle speeds are under 40kph generally do not require motorised and non-motorised vehicles to be segregated.

The CROW Manual makes recommendations regarding when to use different types of facilities. The two determinants are the volume of motor vehicles and the motor vehicle speeds. On facilities where traffic speeds are less than 30 km/hr, no separation is necessary. On facilities with speeds between 30 km/hr and 60 km/hr it depends on the traffic flow. At 40 km/hr, if there are more than 6000 passenger car units (pcu)/24 hours, separate bike facilities can be justified. At over 60 km/hr, with any significant volume of traffic, separated facilities are virtually always recommended.

Notes on chart (right):

- Area 1 - All modes can be mixed. The only reason to consider bicycle tracks or bicycle lanes is for the sake of continuity of design on connecting bicycle routes.
- Area 2 - This situation is merely theoretical.
- Area 3 - In general a profile without segregation is acceptable, but depending on circumstances bicycle tracks or bicycle lanes can be desirable.
- Area 4 - Some form of separation is needed, but visual separation (bicycle lanes) can be acceptable as well.
- Area 5 - Bicycle tracks are desirable, but as densities are low, a mixed profile is acceptable. However, bicycle lanes are not advisable.
- Area 6 - Speed and/or density of traffic flow make it an absolute necessity to segregate bicycles and motor traffic. Separate bicycle tracks are the only option.

There has been a certain amount of criticism leveled at the chart at right, generally by those who feel that specified cycling facilities are not necessary. Drivers should simply share the road with cyclists. For an interesting look into this view, see "***A Review, Comparison with International Practice and Exploration of the Wider Issues Facing Irish Local Authorities***" by Shane Foran of the Galway Cycling Campaign, Ireland on the supporting documentation CD-ROM.

The graph above reflects overwhelmingly the Dutch context with a traffic culture that shows relatively high respect to cyclists and pedestrians, being enforced by traffic calming measures. In the Netherlands, a significant share of all urban roads has a speed limit of 30 km per hour, this will be soon the vast majority. In another traffic culture the need for segregated facilities for cycling is considerably higher since car drivers have to adapt their behavior first before they accept cyclists to share the road. Therefore the application of cycling facilities should be different according to the local and national context.

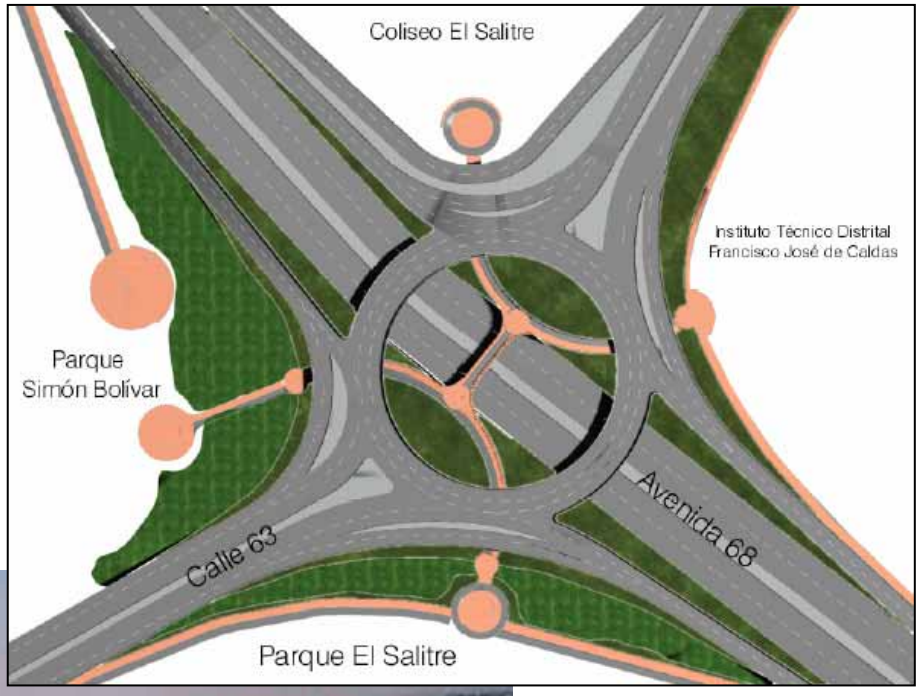
11.4. Intersection design

There are two basic theories about how to integrate non-motorised vehicles into intersections. One is to pull them out of the intersection, and the other is to have them pulled into the intersection. The latter requires low vehicle speeds and it is best if the traffic signal can be programmed to allow cyclists (and pedestrians) to enter the intersection before cars do. Techniques to accomplish this include bike boxes and leading ped/bike indicators. Separating NMVs at intersections is usually reserved for high volume, high speed intersections. In China, Germany and Columbia, there are major highway interchanges where bicyclists have their own fully grade separated route through the interchange, where motorists pass both above and below the bicycle paths (see the example below from Bogotá).

Real Intersection Design

One technique for addressing the competing modes is a workshop called Ressource-Link Real Intersection Design. In this modified charrette, each user group is allowed to redesign the intersection favoring their group, while not completely eliminating others' claims to time and space. The various plans are then compared and contrasted and the salient points are put forward in a composite design. Often it becomes clear that site restraints dictate certain solutions, which benefit most users.

On the supporting documentation CD-ROM you will find an article by Michael King dealing with Real Intersection Design.



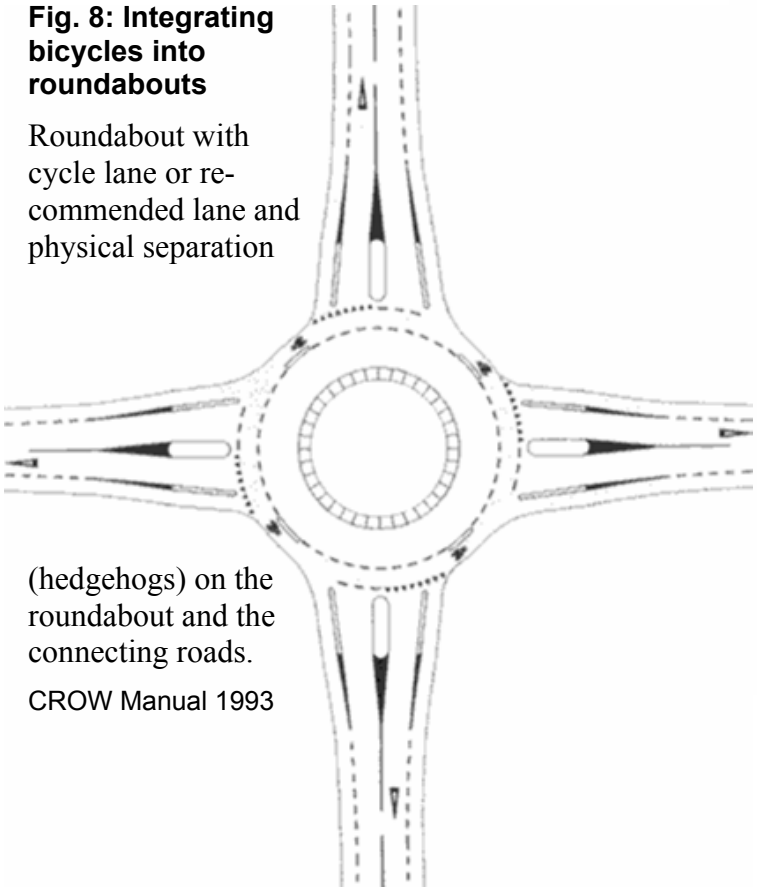
A grade-separated bicycle intersection in Bogotá

Bike Paths Master Plan, Institute of Urban Development, City of Bogotá

- Figure 8 illustrates integrating bicycles into roundabouts.
- Figure 9 illustrates pulling NMVs out of standard intersections.
- Figure 10 and 11 illustrate pulling NMVs into the intersection and getting them to clear the intersection first.

Fig. 8: Integrating bicycles into roundabouts

Roundabout with cycle lane or re-commended lane and physical separation



(hedgehogs) on the roundabout and the connecting roads.

CROW Manual 1993

Fig. 9: Pulling NMVs out of standard intersections (below)

A Bogotá intersection design (bicycles are 'pulled out' of the intersection).

Bike Paths Master Plan, Institute of Urban Development,

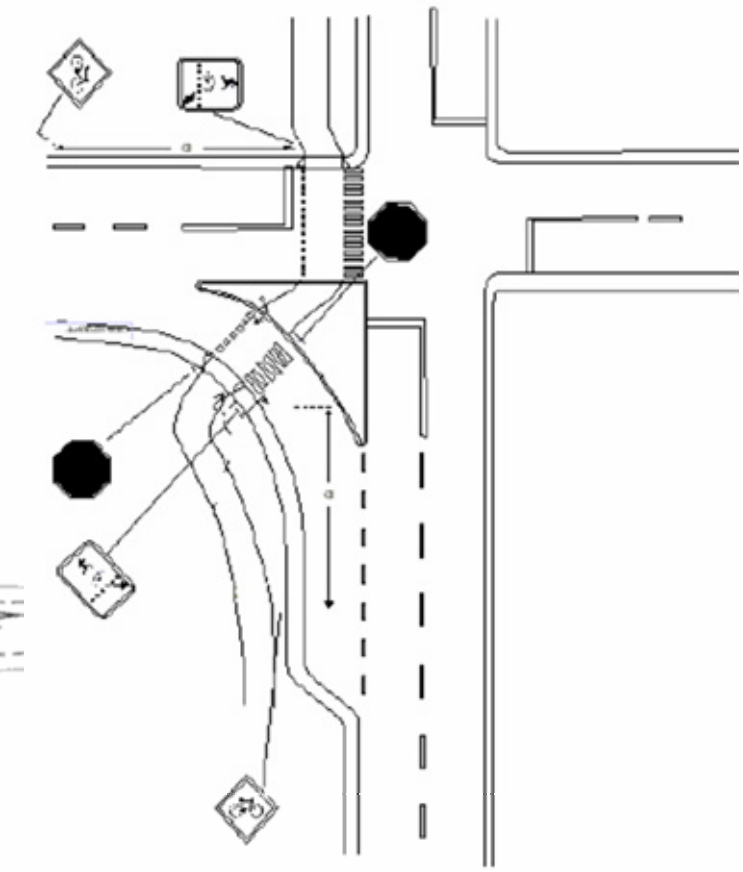
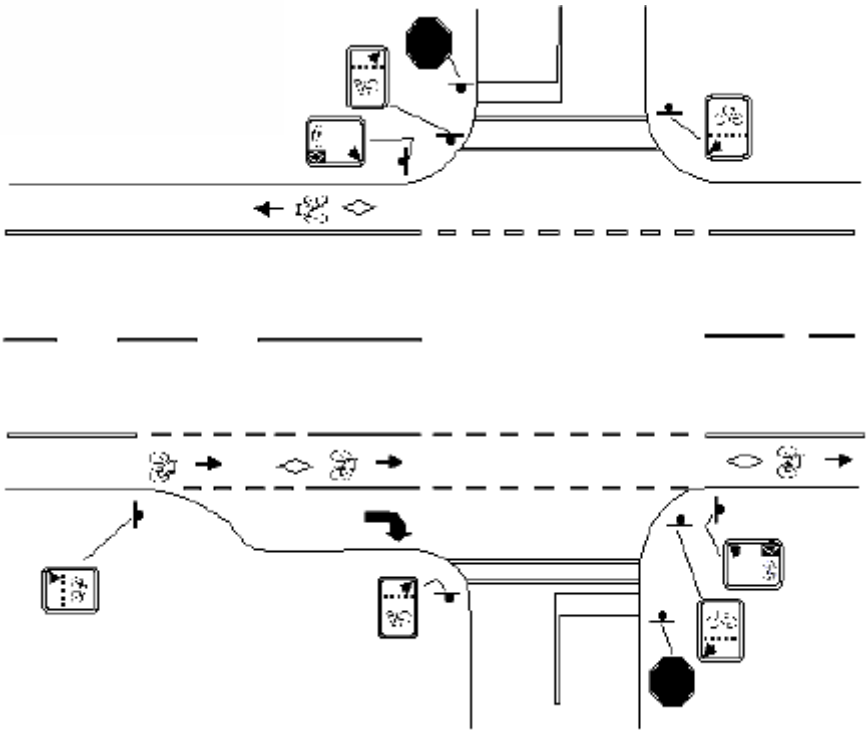


Fig. 10: Pulling NMVs into the intersection (right)

A Bogotá intersection design (bicycles are 'pulled into' the intersection, to clear it first).

Bike Paths Master Plan, Institute of Urban Development, City of Bogotá



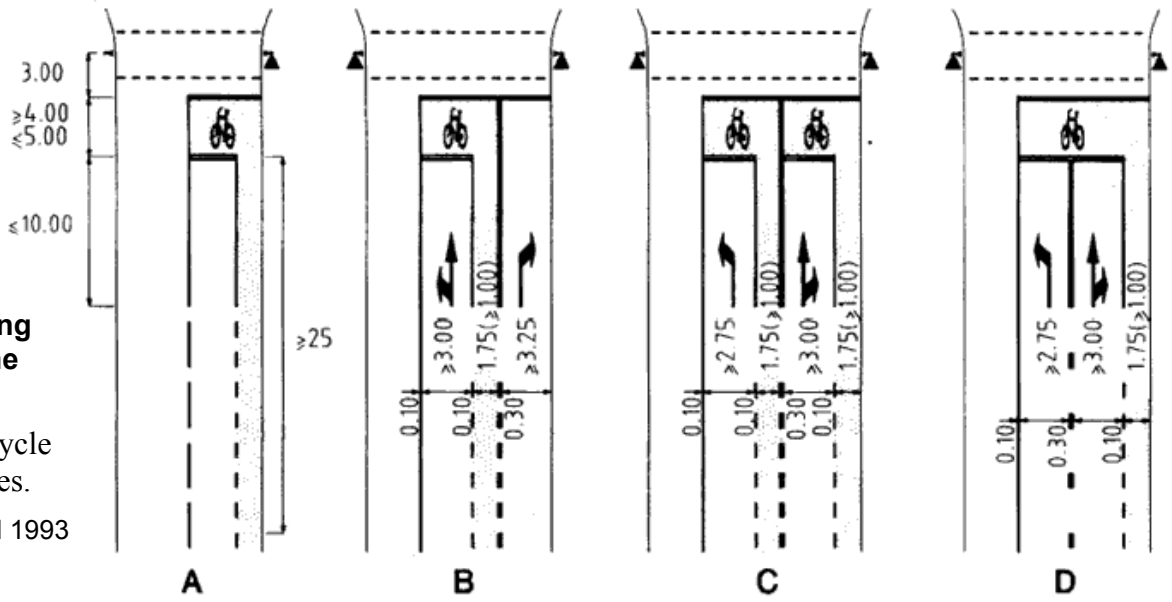


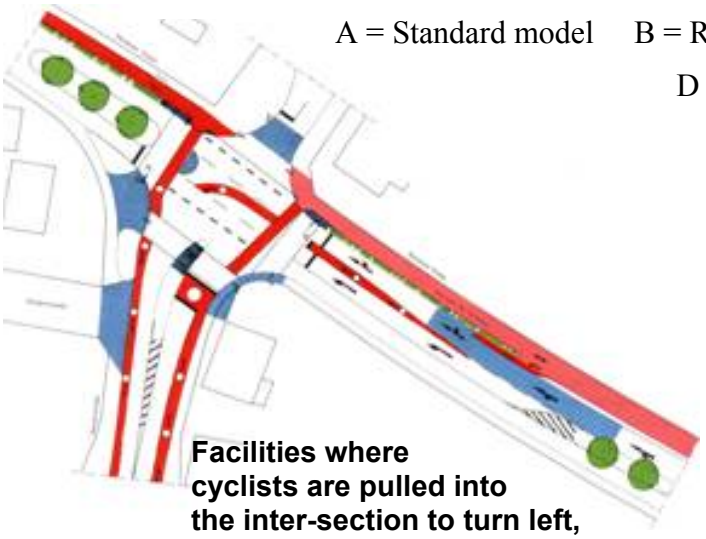
Fig. 11: Pulling NMVs into the intersection

Expanded bicycle streaming lanes.

CROW Manual 1993

A = Standard model B = Right-turning model C = Left-turning model

D = Left-turning model w/o a separate green phase



Facilities where cyclists are pulled into the inter-section to turn left, but also allowed to remain on the periphery, Troisdorf , Germany

ILS-NRW

Intersection in Utrecht , Netherlands , where each mode (foot, bike, car, trolley) has its own lane and signal.

Michael King

In designing intersections, a balance must be achieved between competing modes and directions. Because time is cyclical, for every second of green time allotted to cars traveling one direction, one second must be subtracted from those going another. To prioritize one group means that others will face more delay. Spatially one can create an intersection which allows multiple modes and directions to interface organically (roundabouts), but this is not always possible in every location.

A painted stripe in Offenburg , Germany , gives cyclists a clear space through the intersection

Klaus Banse (taken from GTZ Photo CD 2)

11.5. Design resources

Once you have identified the locations where improving non-motorised vehicle and pedestrian facilities are a priority, specific designs can be developed. This report will briefly review some of the key design considerations, but refers civil engineers implementing NMT projects to one of the various design manuals available. It will also comment briefly on how some of the design manuals, designed primarily for first world conditions, may need to be modified to suit developing country conditions.

- The CROW Manual, ***Sign Up for the Bike: Design Manual for a Cycle-Friendly Infrastructure***, published by the Centre for Research and Contract Standardisation in Civil and Traffic Engineering - The Netherlands is an industry standard.
- AASHTO's ***Guide for the Development of Bicycle Facilities*** is another good guide.
- ***Productive and Livable Cities: Guidelines for Pedestrian and Bicycle Traffic in African Cities***, published by IHE Delft University, is also good and focused on African conditions.
- ***Manual de Diseño de Ciclorutas*** (Cycleway Design Manual), Bogotá, Columbia.
- ***The Transportation Research Board's Highway Capacity Manual 2000, chapter 19 on bicycle traffic.***
- For a simple, two-page level of service assessment used in Britain, see the supporting documentation CD-ROM
- ***Alan Jacobs' Great Streets***

TOUCAN crossing (two modes can cross) where walkers and cyclists can proceed across the intersection, but drivers must turn right, Tucson AZ , USA Michael King

None of these guides, however, deal with large numbers of three-wheeled non-motorised traffic, nor what to do about large numbers of uncontrollable street vendors.

For a more comprehensive look at levels of service analyses, see "***Bicycle Suitability Criteria: Literature Review and State-Of-The-Practice Survey***" by Turner, Shafer and Stewart of the Texas Transportation Institute at Texas A&M University in the USA on the supporting documentation CD-ROM.

Having been written for or based on developed countries, with relatively low cycling rates, none of the above broach the subjects of large numbers of cyclists as in Vietnam, three-wheelers as in India, or the interface with organic street life as in Africa – vendors, for example. For research on these topics, see "***Bicycles- An Integral Part Of Urban Transport System In South Asian Cities***" by Geetam Tiwari of the Transportation Research and Injury Prevention Programme at the Indian Institute of Technology- Delhi in India on the supporting documentation CD-ROM.

Bike Box (space for cyclists to wait ahead of queuing cars), Aachen , Germany
Michael King

In many areas, the United States and European Union compete around the world to spread influence. Cycling design is no different. But which model should the developing world follow? One indicator is fatality rates. In this respect the EU is the clear winner: it is 10 times safer to walk in Europe as in America (per km walked) and four times safer to ride a bike. For more on this, see "***Making Walking and Cycling Safer: Lessons from Europe***" (on the CD-ROM as well) by Pucher and Dijkstra, Rutgers University, USA.

Bike Box (orients cyclists to bike lane on bridge), Vancouver BC , Canada

Peters Stary

11.6. Review questions

1. Suppose you are the chief city planner of your home city, and the mayor has asked you about the feasibility of implementing segregated bicycle lanes in the inner city. What general initial advice would you provide?
2. Make a survey of your colleagues who cycle. Would they initially prefer to ride in striped bike lanes, on separated paths, or with no facilities? What about if they were riding with children or the elderly?
3. On a map of your town, plot out a basic bicycle network. First locate the streets that people already cycle on and identify necessary improvements. Then locate gaps in the system which, if closed could provide superior routes. Keep in mind that some cyclists ride to a specific destination (school, work, park), while others are riding to shop or visit.

12. Local street design

12.1. Local street design

In dense urban areas local streets not only serve short distance trips, they also serve as public space. A street with a high density of pedestrian trips could be in a commercial area in a city center, or it could be in a residential neighborhood. On such streets, many trips begin and end. People will base their decision about whether to drive, walk, cycle, or take the bus based largely on the conditions they face as they walk out the door of their office or their home.

On local streets, the most important measures to consider are parking control, motorised vehicle restrictions (and pedestrianization), traffic calming, and post traffic calming. While bicycle lanes are of little relevance, much can be done to improve the livability of local streets. Vehicle speeds can be slowed down to levels where vehicular movement does not conflict with children playing and people enjoying public space.

The simple posting of bicycle route signs on existing streets can be important for two reasons. First, sometimes non-motorised traffic can be routed off major arterials by taking secondary and tertiary roads. The availability of these routes, however, may not be commonly known. Coded bike routes, coupled with bike maps, can help cyclists identify more bicycle or NMV friendly routes. Secondly, it can be used to indicate that along this route traffic signals, intersections, and roadway maintenance have been designed to prioritise bicycle and other NMV use.

Cyclist on a low speed, narrow street: no special provisions necessary New Orleans, LA, USA

Michael King

Sometimes bicycles and other NMVs might be recommended to use sidewalks in specific locations, and this too can be indicated by roadway signs. Typically, this may occur on bridges or short links of high speed facilities designed with sidewalks and high speed motor vehicle traffic but no space for special NMV facilities, where NMV access is critical to avoid a serious severance problem.

12.2. Parking control

Parking control is a critical element of local street design. On many local streets, public space is appropriated by motorists for vehicle parking, and often this is done without any payment for the service to the public sector.

Every trip begins and ends with a walking trip. If the trip is short, and the walking and cycling environment between the trip origin and trip destination is pleasant and safe, if the side-walks or roads are free of parked cars, and if people have to walk as far to reach their parked car as they have to walk to reach the

Bogotá's 15th Avenue, before and after bringing parking control

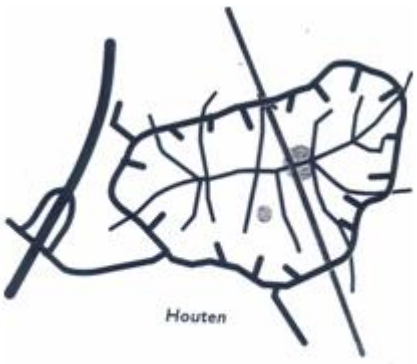
nearest bus line, then more people will walk or cycle for the whole trip or take the bus for longer trips.

On the other hand, if a person can walk out their front door into their private car, and the sidewalk is obstructed by vehicles parked in public space, if the streets have not been designed for safe and pleasant cycling and walking, and if they have to walk half a kilometer to reach the nearest bus line, they will use their car or motorcycle even for a very short trip, needlessly congesting the roads, consuming public space, and increasing air pollution.

Thus, designing streets in residential areas and commercial areas with a pleasant walking environment is critical to the overall efficiency of the entire traffic system. The first step in this process is sorting out access and parking by private vehicles.

12.3. Pedestrian zones

In both residential areas and commercial areas it is likely that there will be a high volume of pedestrian trips. It is rational in such areas to design these streets for safe, comfortable and convenient travel by walking and possibly cycling. Traffic planners should consider the viability of fully pedestrianizing many of these roads, and planning new settlements with local trips fully pedestrianized. Below, the diagram of Houten in the Netherlands, shows that motor vehicle use has restricted access in the city: to go from one neighborhood to another requires taking the ring road, there is no direct link. But pedestrians and cyclists do have direct routes. In this way, short trips will be made by non-motorised modes, and the city will be safe for children.



Cars need to use the ring road to enter another district, there are no direct routes

Interface for Cycling Expertise

In many low income neighborhoods in developing countries, the vast majority of residents will not own a motor vehicle. Many roads will not have public transit lines on them, and no garbage service. For these neighborhoods, local streets are heavily dominated by walking trips, by children playing and elderly people playing cards. Such streets should be designed to facilitate these activities in a safe way. Because of this, simply paving local streets will often lead to a rapid increase in child traffic fatalities.

A non motorised arterial in Bogotá, Colombia

Fundacion por el pais que queremos

The City of Bogotá has taken pedestrianization to a new level by building fully non-motorised arterials into the rapidly de-veloping urban periphery. Because Bogotá's low income communities are growing rapidly, new low income housing units are rapidly developing around these non-motorised arterials which then are used for both commuting by bicycle or walking to the nearest school, shop, or TransMilenio stop, and for public space by children.

Children utilize Bogotá's pedestrian paths to get to schools (left), while cyclists enjoy paths connecting low-income housing units to shops, libraries and Trans-Milenio bus stops.

Even in wealthier urban neighborhoods, where families are wealthy enough to own a private car, public streets in local neighborhoods should still consider tightly regulating access by motorised vehicles to household deliveries, and relocating private vehicular parking to garages adjacent to major arterials.

In downtown commercial areas, where again there may be a very high volume of pedestrian trips, traffic planners may also want to consider full pedestrianization. In cities with good quality public transit systems and high urban density, pedestrian zones have been effective at giving agglomerations of small shop owners a competitive chance against big box retailers and shopping malls.

Pedestrian areas in Shanghai, China (top) and Curitiba, Brazil (below)

ITDP

12.4. Traffic calming and post traffic calming

The idea of traffic calming is simply to design streets in such a way that it is difficult for motorists to drive faster than safe speeds, say 30kph. While the traditional method is known as a 'slow bump', or 'sleeping policeman', placing obstructions in the middle of the roadway, meandering, and rough road surfacing will also serve the same function.

Each of these forms of traffic calming will successfully slow traffic to more humane speeds. The rough road surfacing is not liked by cyclists because it makes for a very rough ride.

Recent work in the Netherlands and Denmark inspired by Hans Monderman and others has gone a step farther than traditional traffic calming measures, and threatens to turn a lot of road safety theory on its head. According to Monderman, motorists will slow down when the roadway does not clearly demarcate pedestrian and roadway facilities through painted lines, signage, even traffic lights. As such, for roads with traffic volumes under 5000 vehicles per day, Monderman recommends removing traffic lights, and all street markings that differentiate pedestrian spaces from motor vehicle spaces.

This recent work, called '**post traffic calming**' has cited evidence that even on small rural roads safety conditions are sometimes improved rather than worsened when the yellow line down the center of the roadway is removed. Because the lack of a central line makes drivers feel insecure, they tend to drive slower and more carefully.

Traffic calming techniques: Obstructions (top) and meandering roads (middle) used to slow traffic. Boulevards where cars are not allowed to pass cyclists (bottom).

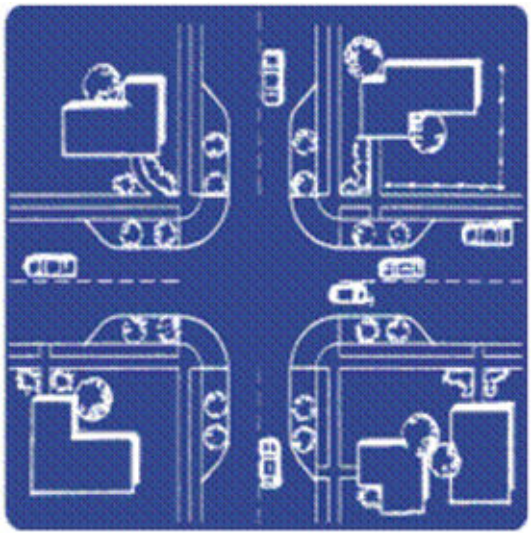
Mayor's office, Bogotá, Colombia (top two), Michael King (bottom)

Examples of post traffic calming from the Netherlands (right) and Guanzhou, China (left). Pedestrians and motorists mix at safe speeds because motorists feel like they don't belong.

Hans Monderman

12.5. Review questions

1. Imagine the local street near your home or office. Does its design encourage or discourage walking and cycling? What could be done to make it safer and more pleasant for non-motorised traffic?
2. What arguments could be made against pedestrianizing specific areas of your city? Where would it be most appropriate?
3. Explain the difference between traffic calming and post traffic calming.



Building out curbs reduce turning ratios and slow speeds at intersections (top).

Top: The Institute for Transportation Engineers
Below: Mayor's office, Bogotá, Colombia

Rough surfaces reduce speeds (below).

13. NMT facilities on highways and primary arterials

13.1. Primary arterials

On limited access highways designed primarily for high speed motorised travel, the best option for pedestrian and cycling facilities is to build fully grade separated facilities at a reasonable distance from the roadway. The Netherlands and England have both built national cycling networks that facilitate long distance and recreational cycling, and these long distance cycling facilities also sometimes play an important role in local cycling and walking networks.

In some locations, highways that carry both bicycle traffic and heavy vehicular traffic are using the same right of way, and there are no simple ways of widening the road and providing facilities for both. In these conditions, a bypass road should be considered, and the existing road should be downgraded to slower speeds.

While cycling on the shoulder of major highways should be allowed if there is no other through route for cyclists, it should be planned for, and access facilities provided, or it should be restricted. Often freeways and primary arterials have medians which can be used for cycling facilities if crossing bridges are provided. Many of the new cycling facilities in Bogotá, Colombia, run down the medians of primary arterials. The advantage of placing the cycling facilities down the medians is that they do not have to conflict with turning traffic. Getting on and off the facility, however, becomes cumbersome and requires the use of multiple overpasses.

Highway outside of Jaipur, India. Since widening is impossible, a bypass might be the best option.

Michael King

13.2. Crossing facilities

Because of the severance problems created by large, high speed, high volume roads, considerable attention needs to be paid to the crossing facilities. The traditional approach to this problem is to use **zebra crossings at signalized intersections**, and to construct **pedestrian and cycling overpasses or underpasses** where there are no nearby signalized intersections but high crossing volumes.

Where there are signalized intersections, there is generally no reason to construct pedestrian overpasses or underpasses, unless the roads are extremely wide (more than four lanes per direction) or the pedestrian volumes extraordinarily high, such as in front of a major railway station. The determining factor should be whether the existing volume of pedestrians can clear the intersection during the signal phase without introducing significant delay in the vehicular traffic.

Pedestrian overpasses are inconvenient, particularly for the elderly, people carrying packages, and small children. Their inconvenience means that frequently pedestrians simply do not use them. There are frequent cases of pedestrians being killed directly under pedestrian overpasses. If pedestrian overpasses are to be built, a few key issues need to be considered. First, **they should be as low as possible given the clearance necessary for the highest vehicle allowed on the road**.

Sometimes bicycles and other NMVs might be recommended to use sidewalks in specific locations, and this too can be indicated by roadway signs. Typically, this may occur on bridges or short links of high speed facilities designed with sidewalks and high speed motor vehicle traffic but no space for special NMV

A needlessly high pedestrian overpass with steep steps in Jakarta is under-utilized and ineffective

ITDP

facilities, where NMV access is critical to avoid a serious severance problem.

Ideally, **pedestrian and cycling crossing facilities should be maintained at grade, while facilities for motorised traffic are forced to go up or down, as hills are less bothersome to motorised traffic than to cyclists and pedestrians**. While such facilities will sometimes be more expensive, if a major interchange is being reconstructed anyway, the additional cost of designing NMT facilities in this way will be marginal.

Multiple at-grade pedestrian refuge islands combined with zebra crossings can also be

Gradual sloping cycle and pedestrian overpass with no steps, Bogotá ITDP

used as an alternative to a pedestrian overpass even on high speed roads. Even at fairly high volumes and high speeds, spaces between motorised vehicles are frequent and sufficiently large as to permit pedestrians to cross one or two lanes of traffic. As such, the placement of multiple pedestrian refuge islands every lane or every two lanes can be a viable substitute for pedestrian overpasses. Some successful experiments have been done in Africa, but thus far few have been done on very wide roads.

13.3. Review questions

1. List the major advantages and disadvantages of pedestrian and cycling overpasses.

Bogotá: North-South motorised traffic elevated, East-West motorised traffic depressed, and facilities for non-motorised travel are at ground level.

14. Mixed use or secondary arterial NMT design

14.1. Integrating NMT on Mixed Use or Secondary Arterials

Most of the design issues for integrating cycling, walking, and motorised vehicular traffic primarily occur on secondary arterials or mixed use arterials. It is on such roads where for the entire traffic system to work the needs of cyclists, pedestrians, and motorists need to be carefully balanced.

One approach is to use some standard parameters. One example is the Dutch chart (above) for selecting cycling facilities based on vehicle volume and speed. Other countries have developed similar charts. The paper "***Bicycle Facility Selection: A comparison of approaches***" on the supporting documentation CD-ROM reviews international practice. These guides are useful design tools given particular site constraints.

Below, the ***Bicycle Compatibility Index*** has been graphed to speed-volume charts per level of service (LOS). Say we have a street with vehicle speeds of 56 km/h and 5000 vehicles per day. If our bike policy is for LOS-C, then we should stripe a bike lane or shoulder. If our LOS is D, then we only need a wide curb lane.

If we have not the room for a bike or wide curb lane – the road is too narrow or on-street parking cannot be removed – then to obtain a LOS-D, we would need to lower the speeds to 48 km/h, or lower the volumes to under 4250 per day. For LOS-C, we would have to lower the speeds to less than 40 km/h, regardless of volumes. Of course there are other variables such as parking, trucks and turning vehicles which will color the decision, but the basic idea remains the same.

This type of exercise can be used not only in the selection and design of facilities, but also in the planning process. One could map the speeds, volumes and street configuration throughout an area and determine not only the existing cycling LOS, but also what would be required to raise the LOS to the desired.

The LOS for cyclists will also be a function of the number of cyclists using the facilities.

In the US, the minimum allowable width of a bicycle lane is 1.2 metres if there is no parking adjacent to the lane. If there is parking adjacent it must be 1.5 metres or more. These measurements do not assume the use of three wheelers. If three wheelers are used, the minimum recommended NMV lane width for a one-way facility is 2 metres. This will just allow one three wheeler to pass another three wheeler which might be stopped. If NMV flows are high enough to justify wider lanes, they should be adjusted accordingly.

If the number of cyclists or cyclist equivalents (with three wheelers counting for three cyclists), rises above 150 per direction per hour, the CROW Manual recommends the width of the cycle lane be increased from a minimum of 1.5 to 2.5 metres, and if volumes are over 750 per direction per hour, they recommend 3.5 metres. If mopeds or other slow moving motorcycles are allowed on the same facility, it is recommended to increasing the width by another half metre.

Ideally, parking should not be allowed adjacent to an NMV lane, as the greatest hazard for NMVs is having a motor vehicle passenger throw open their door directly in front of them. However, this is not always possible. In the US, it is considered preferable to have the parking lane next to the curb, rather than the NMV lane next to the curb. However, if the bike lane is sufficiently wide, parked vehicles can serve as a further barrier between the cycleway and motor vehicle traffic.

LOS-C	40 km/h	48 km/h	56 km/h	64 km/h
No provisions	--	--	--	--
Wide curb lane	<3000 ADT	--	--	--
Bike lane or shoulder	3000-11000	<10000 ADT	<8500 ADT	<7000 ADT
Separated lane or facility	11000-18000	10000-18000	8500-18000	7000-18000

14.2. Wide curb lanes and non-physically separated NMV lanes

There is little functional difference between a wide curb lane and a painted, non-physically separated bicycle lane. The main advantages of adding such a lane over having no special NMV lane indication are:

- If a road is highly congested, where actual motor vehicle speeds have declined to levels below average bicycle operating speeds (roughly 12 – 16 km/hr), and if the roadway is sufficiently wide to accommodate a bicycle lane in addition to the existing motor vehicle lanes (perhaps narrowing the motor vehicle lanes will be necessary), the addition of a NMV lane will allow the NMVs to operate at higher speeds than the motor vehicles, without compromising motor vehicle speeds. This can encourage the use of non-motorised modes.
- The bike lane can be used to narrow motor vehicle lane widths, which will encourage slower and safer speeds by motorists.
- A bicycle lane can give cyclists a greater sense of entitlement to the road, and sends a signal to motorists that the bicycles have a clear right to be there.
- The painted facility can lead to more orderly and predictable traffic behavior by the motorised and non-motorised modes, modestly increasing traffic capacity for the motorised modes by preventing the NMVs from occupying a full vehicle lane.

Cyclists riding in the parking lane, Palo Alto, CA, USA Andy Clarke

Curb-side bicycle lanes, Ghangzhou, China

Michael King

The advantages of having a non-physically separated NMV lane over a physically separated NMV lane are as follows:

- It is cheaper
- It is less likely to be occupied by street vendors and pedestrians
- It is less likely to become obstructed by refuse, debris, snow, or construction materials, or wide three wheeled NMVs.
- It is easier to clean, maintain, and remove snow and debris
- If it does become obstructed, it is easier for the cyclist to get around the obstruction.

For candid discussions on the virtues of off- versus on-street cycling facilities see "***Listening to Bike Lanes: Moving Beyond the Feud***" by Jeffrey Hiles, and "***Cycling Safety on Bikeways vs. Roads***" by John Pucher of Rutgers University in the USA, both on the supporting documentation CD-ROM.

If a non-physically separated NMV lane is selected, some determination needs to be made as to whether the main users of the facility will be standard bicycles, three wheelers, or a combination of both. This can be determined based on the data collected above. Another consideration is whether or not parking is allowed on the curb lane.

On one-way streets, if the lane is not physically separated, the NMV lane should also be one-way. In countries where motorists drive on the right side of the road, it is preferable to have the NMV facility on the right side of the road. Bicyclists traveling the wrong direction on a one-way bike lane are a major cause of accidents.

14.3. Physically separated or partially separated NMV lanes

There are advantages and disadvantages of having physically separated NMV lanes as opposed to lanes only separated by road markings.

Advantages are:

- They are less frequently obstructed by double parked cars or illegal use by motor vehicles and motorcycles.
- They provided a greater sense of security to the NMV user.
- They can allow for two-directional NMV travel even on one-way roads.
- They ensure that NMV users will not make sudden movements into the motor-vehicle lanes or obstruct motorists.
- They are self-enforcing.

The disadvantages include:

- If they are too narrow, a single three wheeler can obstruct the lane.
- If the lane is obstructed, it is very inconvenient to go around the obstruction.

A two-way bicycle lane combined with a pedestrian sidewalk, Paris 2002

Armin Wagner

more prone to filling with debris, vendors, snow, etc.

- They must be placed on the curb-side of any parking vehicles, or in the median strip.
- They can make truck deliveries to store-fronts less convenient.
- Facilities placed in the median strip cause special problems at intersections.

The dimensions for the facility will be roughly

- They are

Narrow, poorly maintained cycling lanes, such as these from Lima, Peru, can be worse than no cycling facilities at all.

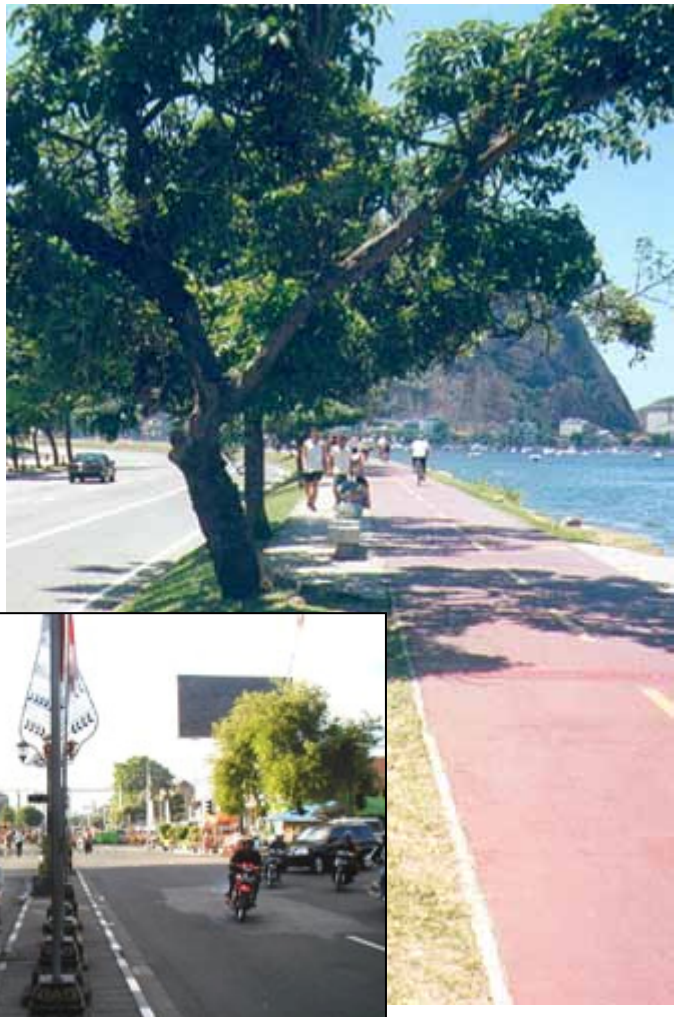
Mayor's office, Bogotá, Colombia (left), Michael King (right)

the same as for other bike lanes. The minimum width for a two-directional NMV lane with any three wheeler traffic should be 2.4 metres, with 4 metres recommended.

Top: A separated and broad service lane with high bicycle volumes in Nanjing, though as in other Chinese cities, motor vehicles are increasingly intruding. Karl Fjellstrom

Right: A cycle way along the coastline, Rio de Janeiro 2000 Lloyd Wright

Right bottom: Separated non-motorised vehicle lane on central shopping street, Yogyakarta, Indonesia
Bottom left: Separated bicycle path in the center median, Mexico City, Mexico.



14.4. Review questions

1. Suppose you are the chief city planner of your home city, and the mayor has asked you about the feasibility of implementing segregated bicycle lanes in the inner city. What general initial advice would you provide?
2. Make a survey of your colleagues who cycle. Would they initially prefer to ride in striped bike lanes, on separated paths, or with no facilities? What about if they were riding with children or the elderly?
3. On a map of your town, plot out a basic bicycle network. First locate the streets that people already cycle on and identify necessary improvements. Then locate gaps in the system which, if closed could provide superior routes. Keep in mind that some cyclists ride to a specific destination (school, work, park), while others are riding to shop or visit.

15. Advice on how to achieve implementation

15.1. Overcoming political, technical and cultural barriers

To avoid mistakes and delays in urban NMT planning and implementation, one should look at the typical barriers, when working with municipalities and local NGOs. Recent experience shows, that urban NMT projects stuck because of:

- lack of transparency within a municipality due to insufficient communication structures between the different stakeholders (priorities, time-and work-plans and tasks are not clearly articulated and circulated)
- resistance of some decision makers with specific interventions (e.g. where urban space/road space has to be reorganised – loss of parking fees)
- time losses in design of NMT infrastructure due to lack of design expertise of local engineers in the field of road safety and NMT infrastructure
- municipalities are not taking over ownership
- if projects have to be co-financed by the local partner-city: municipalities often do not find or are not willing to redefine municipal budgets for the construction of NMT infrastructure in the expected timeframe

Consequently, the first aim is to integrate awareness of NMT into several key areas of public policy and decision-making. Key areas where awareness of NMT is critical to successful policymaking include transportation infrastructure planning, design and engineering, public service provision, poverty alleviation efforts, small business development efforts, road safety efforts, and environmental efforts. Ultimately, however, the question of integrating NMT concerns into these areas of public policy cannot be separated from the question of how and by whom these concerns will be integrated into these various areas of public policy.

As the above project experience indicates, in some cases national-level working groups on low cost transport or non-motorised transport have played a key role in raising awareness of NMT issues among public officials. Forming some sort of intergovernmental task force on non-motorised transport at either the national or municipal level is often an effective mechanism for raising awareness of NMT issues and coordinating NMT activities across various ministries. The National Forum Groups of IFRTD in Kenya for example meets on a fairly regular basis with some officials from various departments of government, hosting guest speakers, and discussing how to address both urban and rural transportation issues. In some countries and internationally professional associations like the NMT Task Force at the Transportation Research Board play a key role in raising NMT awareness among policy makers.

Ultimately, the key is to establish specific persons either inside or outside the municipality or both whose job it is to monitor municipal activity and work together with representatives of the most relevant stakeholders (this depends on the local situation of each city - see table below) in an NMT Task Force.

Once such an institution is established, they can run or organize the following activities:

- Helping in establishing professional capacity within municipal organisations
- Studying the mobility of the urban poor
- Training and awareness raising workshops among municipal government staff (by showing cases of successful planning)
- Helping municipalities and national governments develop NMT policies
- Establishing a clear organization of institutional responsibilities in municipality
- Oversee the budgeting process to ensure NMT receives a fair share of municipal funds

- Organizing stakeholder workshops on major NMT projects or projects that affect non-motorised travel.
- Assisting Municipality in identifying, designing, implementing and monitoring test interventions
- Making sure that municipality takes over ownership of the project/plan

Another necessary benchmark to reach sustainable NMT policies is to ensure the long-term participation of all stakeholders, users and potential users (see table below). To stimulate their participation, user surveys, stakeholder consultations and sensitisations (demonstration projects) should be implemented to raise awareness about low-cost options, identify transport problems of focus groups (e.g. women, the unemployed youth, disabled a.o.) and understand the needs of the community before starting a project or programme.

Group stakeholders can be overviewed in the table 1.

To assure a successful future for the project, efficiency and effectiveness of the key actors in planning, implementation and monitoring have to be improved significantly. Table 2 gives an overview about typical needs in capacity building, when a local NGO is involved.

Table 1: Group stakeholders

	ADMINISTRATION	***ROAD USERS / REPRESENTATIVES (Civil Society)***	***RESEARCH AND TRAINING INSTITUTES***
Demand side of mobility ▪ Informal sector ▪ Service sector ▪ Industry	**National Authorities** ▪ Ministry of Transport, Works + Housing ▪ Ministry of Finance ▪ Ministry of Justice ▪ Ministry of Interior ▪ Parliament	**Non-Motorised Transport** ▪ Pedestrians ▪ Cyclists, bicycle taxis ▪ Bicycle Taxi Driver Association ▪ Carts ▪ Bicycle Advocacy Groups ▪ Local Communities ▪ Resident committees	**National** ▪ Civil engineering ▪ Urban planning ▪ Transport and logistics ▪ construction design Bureaus
Supply side of mobility ▪ Bicycle- Producers ▪ Bicycle-Sellers ▪ Renters ▪ Repairers ▪ Parking-lot-guards	**District Officials**	**Motorised Transport** ▪ Automobile advocacy groups ▪ MT passengers ▪ Public transport Operators ▪ Public transport advocacy groups ▪ Private Bus Operators	**International** ▪ Experts ▪ Organisations ▪ Institutes
	Local Government		
	Municipal Authorities Department of Transport Department of Urban Planning Department of Police	**The Media**	

SECTIONS TARGETED	MUNICIPALITY			Local NGO	
	Engineering Department	**Planning Department**	**Traffic Department**	**Technical Staff**	**Secretariat**
Types of capacity (Short Term)	▪ Designing of infrastructure ▪ NMT specific knowledge	▪ Monitoring and evaluation ▪ Reporting and documentation ▪ NMT specific knowledge	▪ Communication management and coordination ▪ NMT specific knowledge	▪ NMT specific knowledge ▪ User-participation approaches and methodology	▪ Information coordination production and presentation of reports and documents
Types of capacity (Long Term)		▪ Monitoring and evaluation	▪ Enforcement of law and order		

Table 2: needs in capacity building

15.2. Political commitment

Politically, it is often easier to implement an extremely expensive metro or highway project than even the simple improvement of a sidewalk. This is because any large construction project has large interests which stand to make a lot of money if the project is implemented, and therefore are willing to push government officials on a regular basis to ensure it is implemented. Politicians also stand to gain by being identified with the completion of public works. Even though basic improvements like the construction of sidewalks may do more to alleviate traffic congestion and road accidents than other projects costing hundreds of times more, the very low cost nature of these improvements makes it difficult to find a political constituency to ensure their implementation.

Historically, these sorts of projects have come about because someone with political power, money, and perseverance made them happen. The most recent large-scale non-motorised transport improvement was done in the city of Bogotá. In Bogotá, improving the city's transportation system in this way was a major campaign promise of Mayor Enrique Penalosa who was personally convinced of the importance of such measures. In the city of Bogotá, the Mayor also has enormous power, unlike in some other cities where the mayor is less powerful. Support for the NMT improvements from the NGO community existed, but it was clearly the Mayor's office which pushed it forward. Similarly, the pedestrianisation of downtown Curitiba, Brazil, was also pushed through by an enlightened Mayor (see *Module 1a: The Role of Transport in Urban Development Policy*). The prioritisation of bicycle use in China was a decision by the highest levels of the national government and party, just as today the restrictions against bike use are being pushed through national level political pressure.

In other locations, pressure from bicyclists, NGOs, and international funding agencies has proven critical. The bike facilities in most large US cities, in Western Europe, in Central Europe (Krakow, Budapest, etc), in Bangkok, and the dramatic improvement in pedestrian facilities in Seoul clearly resulted from pressure applied to governments by NGOs and cycling federations. In Accra and Tamale (Ghana), in Tanzania, in Marakina (Manila/Philippines), Lima (Peru), Gdansk (Poland), Yogyakarta (Indonesia), and Santiago de Chile, new bike and other NMV facilities were given a strong push by international organisations such as the World Bank or UNDP, and often more specifically

committed individuals within these institutions.

Other factors critical to ensuring implementation are good public education efforts through the media. If the Mayor fully supports the plans, he can use his access to media to push them forward. NGOs can also make clever use of the media to win popular support for NMT improvements.

Involving all the relevant stakeholders both inside and outside the government in the planning process from the outset, and letting them take ownership of the plans, is also likely to reduce significant obstacles to implementation.

15.3. Cost, and time frame for implementation

While it can cost tens of millions of dollars to properly reconstruct a single major public transit hub or intersection to ensure safe non-motorised travel integration, many measures to improve conditions for non-motorised transport can be done for the cost of basic roadway paint. Construction costs vary from country to country. Most measures can also be implemented rapidly, in less than a year. Physical construction for pilot projects will take weeks rather than months.

Developing cities should start by forming a non-motorised transport task force, which can initiate a planning process. This task force can then begin to develop and implement measures, beginning with isolated improvements, and in a relatively short period laying the foundation for a city-wide network of non-motorised transport routes.

15.4. Financing NMT infrastructure

Infrastructure such as sidewalks and bicycle routes is generally quite inexpensive. Municipalities claiming they do not have sufficient funds are often just making excuses. Ideally NMT infrastructure should be funded out of the normal operating budgets of the departments of roads, public works, or transportation, rather than requiring some special source of financing. Most of the bicycle and pedestrian infrastructure that has been built in Africa has been part of a larger road reconstruction project, often funded by the World Bank or other international donor agencies. The marginal cost of adding bicycle and pedestrian facilities is usually quite modest. Prior to exploring new possible sources of funding, municipal governments should simply use existing regular budgetary sources.

The source of this municipal revenue is likely to vary widely. In Africa, it is quite common for most municipal revenues to be passed down from the national government. However, municipalities should do more to raise local funds where this is legal and possible, and national governments should do more to decentralize control over the following fees for use by municipalities on a variety of infrastructure needs. Typical sources of such revenues would be:

- vehicle registration fees and other vehicle taxes,
- local gasoline tax,
- parking charges,
- revenues from traffic violations,
- revenues from advertising on bus shelters and along roadways.

Congestion pricing and tolls on urban roads, betterment taxes, pollution taxes, carbon taxes, luxury car taxes, etc. could all be used but experience with these tax revenues is limited.

Creating a downtown commercial pedestrian zone of some architectural merit might require creating new sources of funds. In developed countries it would be typical to create a business improvement district where the businesses in the district agreed to a special tax levy to make significant improvements in the quality of public services and the street environment in their area. Experience with this in developing countries is also quite limited.

For more information, please see ***Financing Urban Roads in Developing Countries by Gerhard Metschies***.

15.5. Technical assistence and support

A lot of information and best practises are to be found in the ressource chapter below. There is also specialised consulting expertice available, be it by international consulting companies, NGOs, networks such as for example ***URBal-Cycling*** (a project funded by the EU - see http://www.urbalcyclinginfo.org).

15.6. Review questions

1. What are the advantages and disadvantages of using case studies to build political support for NMT improvements?

16. Further resources

16.1. Publications

The CD-ROM icon in front of an entry indicates that this document is part of the supporting documentation CD-ROM, which can be obtained from the GTZ transport section: transport@gtz.de

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A Guide for Achieving Flexibility in Highway Design, AASTO, 2004

A LIFETIME OF WALKING - Poverty and Transportation in Wuhan, Economic Research Institute, Wuhan University, 2003

A Policy on Geometric Design of Highways and Streets, AASTO, 2004, Publication Code: GDHS-5-G

A Review of Pedestrian Safety Research in the United States and Abroad, Publication Code: FHWA-RD-03-024, 2004, available from www.fhwa.dot.go

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Beautiful Roads: A Handbook on Road Architecture (English), 2002, available from www.vd.dk

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- *Bicycle Reference Manual for Developing Countries*, Barbara Gruehl Kipke, 04/1991, available at www.mobility-consultant.com

Canadian Guide To Neighboorhood Traffic Calming, 1998, available from www.ite.org

- *Canadian Research on Pedestrian Safety*, 1999, Publication Code: FHWA-RD-99-090, available from www.fhwa.dot.gov

Cities on the Move: A World Bank Urban Transport Strategy Review, 2002, ISBN: 0-8213-5148-6, available from publications.worldbank.org

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16.2. Websites

US American Association of State Highway and Transportation Officials
website: www.aashto.org

America Walks
Good set of links to other websites and resources at www.americawalks.org

Bicycle Master Plan by the City of Delft
More information about the Delft bicycle master plan, its aims, implementation and results as well as further Resources you can find on SURBAN (database on sustainable urban development in Europe) at: http://www.eaue.de/winuwd/78.htm

Developing Urban Management And Safety (DUMAS)
Series of workpackages covering Accident Investigation (4), Speed Management (5), and Safety for Pedestrians and Two-wheelers (6) at www.trl.co.uk/dumas

Federal Highway Administration (United States)
The Pedestrian/Bicycle Safety Program provides information and resources aimed to improving pedestrian and bicyclist safety at: safety.fhwa.dot.gov/programs/ped_bike.htm

Pedestrian and Bicycle Information Center (PBIC)
Information for NMT at www.walkinginfo.org and www.bicyclinginfo.org
Extensive set of NMT images, most from North America and Europe at www.pedbikeimages.org

Swedish Traffic Conflict Technique
Methodology to rate the safety of a roadway or intersection based on the potential for conflict, as opposed to waiting for crash data.
www.tft.lth.se

Study on Planning for Pedestrians in Hong Kong
Formulates a broad planning framework setting out principles, concepts, standards and guidelines for pedestrian planning, from the Honk Kong Planning Department's website at:
www.info.gov.hk/planning/p_study/prog_s/pedestrian/ped_report/e_index.htm

URBal-Cycling
The URB-AL program is a horizontal program of decentralized co-operation of the European Commission that brings together cities, agglomerations and regions in the European Union and Latin America. It deals in particular with increasing the transfers of knowledge, experiences and know how. It has compiled an impressive handbook.
www.urbalcyclinginfo.org

Walking School Bus Information Website
Describes the idea of a walking school bus, which provides children with a safe and healthy mode of transportation to school.
www.walkingschoolbus.org

ANNEX 1 - Cycling and Health

Francesca Racioppi, World Health Organization[2]

1. The importance of the social interest

Motorized transport has a broad range of adverse effects on health and the environment. For the WHO European Region (52 countries and nearly 900 million inhabitants), this can be summarized as follows:

An overview of the health effects of transport in the WHO European Region

- Approximately 127,000 people (ca. 1.3 % of total mortality) are estimated to die every year and more than 2.4 million are injured as a result of road traffic collisions. Road traffic injuries are the leading cause of death for people aged 5-29 years. The majority of road traffic crashes happen in urban areas, and pedestrians and cyclists account for one third of all deaths.[3],[4].

- The number of people who are estimated to die prematurely as a result of their exposure to air pollutants is in the order of 100,000 per year (ca. 1.0 % of total mortality)[5]. It is also estimated that between 4 000 and 13 000 deaths per year among children 0-4 years are attributable to outdoor air pollution (based on PM10)[6] and that up to 5 000 lives per year could be saved among children 0-4 years if pollution levels were decreased across the Region to the EU guideline level of 40 μg/m^3 set for 2005[7]. In urban areas, a large proportion of air pollution is emitted from the transport sector.

- Transport (road, rail and air traffic) is the most important source of community noise in the European Region. Approximately 30% of the European Union's population (EU15), or close to 120 million people are exposed to levels of road traffic noise of more than 55 dB(A), i.e. the WHO guideline value for outdoor living areas. Exposure to noise causes annoyance, sleep disturbance, stress and has effects on children's learning: recent evidence indicates that an increase in aircraft noise exposure is associated with up to six months impairment in reading age. It is also suspected to contribute to the development other adverse health outcomes, such as cardiovascular diseases.[8]

- Mortality attributed to physical inactivity is estimated in the order of 600,000 deaths per year, i.e. between 5 and 10 per cent of the total mortality in different European countries.[9].

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[2] www.thepep.org

3 World Health Organization Regional Office for Europe *Preventing Road Traffic Injury: a public health perspective for Europe* (2004)

4 United Nations Economic Commission for Europe *Statistics of Road Traffic Accidents in Europe and North America* (2004)

5 World Health Organization *World Health Report 2002: Reducing Risk, promoting healthy life* (2002)

[6] The lower estimate of 4,000 deaths is based on the application of relative risks to mortality due to acute respiratory infections only, while the upper estimate is based on the application of relative risks to all causes of mortality

[7] Valent F et al. *Burden of disease attributable to selected environmental factors and injuries among Europe's children and adolescents.* Geneva, World Health Organization, 2004 (WHO Environmental Burden of Disease Series, No. 8).

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- Other effects of transport on health include psychological and social ones, such as post-traumatic stress disorder in victims of injuries, isolation of vulnerable groups and constrains on the development of neighbourhood support networks. In addition, transport-related emissions of gases that cause climate change are expected to contribute to extreme weather events while emissions that contaminate soil and water may also contribute to the risk of increasing the intake of chemical pollutants through the consumption of food and drinking water.

The above costs to society dearly: the external costs of transport, i.e. the costs that are generally not or only partly borne by individual users, and which normally include costs of air pollution, noise, safety risks to others, infrastructure costs, and also the costs of congestion, are estimated at about 8 % of the GDP[10].

Given the magnitude of the above effects, even relatively minor changes in modal shares could result in significant reductions of the burden of disease and injury.

2. The contribution that cycling provides towards improving this social interest

Cycling, together with walking and in association with public transport, can broaden up the range of transport choices available to consumers. In particular, safe walking and cycling, in combination with efficient public transport, can play a major role in re-establishing or maintaining adequate levels of physical activity in the general population and decreasing the risk of cardiovascular diseases, diabetes, hypertension, some cancers, as well as risks related to overweight and obesity. Studies investigating the effects of cycling for transport on health are very scarce. However, one of these studies observed, among other findings, that those who did not cycle to work had a 39% higher mortality rate than those who cycled to work at the beginning of the study, irrespective of the level of other leisure-time physical activity and the other factors investigated[11]. The more cyclists are on the road, the better is seems to be safety- wise, and a sort of “critical mass” effect has been modelled in another study, which found that the likelihood that a given person walking or bicycling will be struck by a motorist varies inversely with the amount of walking or bicycling. This pattern is consistent across communities of varying size, from specific intersections to cities and countries, and across time periods12.

3. The specific (added) value of cycling relative to alternatives that can serve this social interest

From a social marketing point of view, what is particularly interesting of cycling (and walking) is that part of the benefits is enjoyed directly by the individuals who are switching to these transport means. This means that, at least in theory, a motivation to consider modifying travel behaviours could be found not only in an acceptance of “altruistic” values (I wish to leave to the next generation a cleaner world) which can be more easily traded-off in a competition for marginal travels choices (this time I really “need” to use the car for this journey), but also in the self-interest of road users (I cycle because it is my bodyweight/hypertension that would go under control, it is me who enjoys riding a bicycle through a nice urban setting). From the point of view of public (and private) investors, the appeal of investing in cycling (provision of services and infrastructure) can become stronger when this investment is placed in a broader persective of expenses and savings: the pioneering study done in Norway on the costs and benefits of investing in infrastructures for cyclists and pedestrians shows that when the

[10] European Environment Agency *Transport price signals* (2004) Technical Report 3/2004
[11] ANDERSEN, L.B. ET AL. All-cause mortality associated with physical activity during leisure time, work, sports, and cycling to work (archinte.ama-assn.org/issues/v160n11/toc.html). *Archives of internal medicine*, **160**(11): 1621–1628 (2000) (accessed 19 March 2002).
[12] P L Jacobsen Safety in numbers: more walkers and bicyclists, safer walking and bicycling *Injury Prevention* 2003;9:205–209

savings of health costs are brought into the equation, the investments become very sound.[13]. The other interesting feature of cycling is that can be a realistic option in European urban contexts, as some 50 % of car trips are shorter than 5 km, i.e. a distance where cycling can effectively compete in terms of speed and acceptability of the physical effort with a short journey by car.

4. The target group (segment) within the population of road users for which the social interest is most relevant

From a public health perspective and considering the goal of achieving at least 30 minutes of daily moderate physical activity in the adult population, the population group that would benefit most from a shift to cycling is the sedentary one, as for this group even small increases in physical activity yield relevant health improvements. This group overlaps reasonably well with a large percentage of those who are travelling predominantly as car drivers/passengers, but it may not coincide entirely with it (e.g. overweight house-wives from economically/socially deprived groups without access to private cars; children and elderly who cannot drive motorized vehicles). So, social marketing strategies should identify different target groups, and tailor different messages and products to meet the specific needs of these categories. In other words, the “concept” of cycling should be articulated in different ways according to the target audience. Health promotion professionals can support efforts in targeting groups with different types of risks, but the ability to communicate effectively to an audience which is the target of highly sophisticated marketing messages and to make them “buying” into cycling not as a “medical obligation”, but as the most convenient and pleasant travel choice remains a challenge so far not yet overcome.

The results of the projects such as TAPESTRY (http://www.eu-tapestry.org/) and INPHORMM http://www.wmin.ac.uk/transport/inphormm/4.htm could provide some useful information about aspects concerning the design of social marketing campaigns.

5. The (potential) demand for cycling by the selected target group of road users, and the obstacles that prevent them from currently using the bicycle

Studies indicate that people feel prevented from engaging more in cycling (and walking) because of fear of safety and security, as well as in relation to the perceived conditions of the surrounding physical environment (e.g. see J Epidemiol Community Health 2004;58:924–928, on walking in the UK). Therefore, addressing the different needs for safety and security (e.g. for women and children) as well as the availability of the services and amenities to be reached within a distance which can be covered by bicycle (on foot) become essential pre-requisites for achieving more cycling (and walking.). When it comes to cycling, another relevant areas that needs to be addressed is that of safe and convenient storage of the vehicle: in many European cities people living in building blocks have no convenient and safe places where to store their bicycles, and very often regulations in place in condominiums do not allow people from parking the bicycles in the common areas of the buildings (e.g. entrances, outside the apartment door). Similarly, public garages and other secure forms of shelter may be not available and/or affordable and very often the space available in city apartments is too small to allow for bicycles to be stored inside apartments. The same applies to work places (in many European cities these are not available) and to inter-modal exchange areas where bicycles could be used to reach a train/bus station, but then they cannot be left at secure places. Addressing these aspects could be particularly relevant to

13 Saelensminde, K. (2002) Walking and cycling track networks in Norwegian Cities – Cost-benefit analyses including health effects and external costs of road traffic. Institute of Transport Economics, Norway.TOI report 567/2002 – (Norwegian language)

make the most sedentary (i.e. the top priority group) changing their minds and starting contemplating the possibility of cycling.

6. **Given the potential for cycling promotion, identify the cycling product that matches the demand of the target group to eliminate at least some obstacles to cycling use**

Safety/security conditions should be addressed as a matter of top priority, but then attention should be given to the other services and products that could overcome the above difficulties with secure and convenient storage, including facilitating revisions of regulations for condominium blocks and work places to make it possible for bicyclist to store their bicycles at home, and at the work place. Services for commuters using the bicycle as part of inter-modal transport are equally important. The availability of comfortable yet good-looking clothing that could be used by commuters without making them looking "odd" at work place or having to shower and change before being "presentable" is another aspect worth receiving attention.

7. **The product specifications for the different public and private organisations to address the potential demand**

The role of the public sector is more easily in the domain of providing the appropriate supportive policy environment for promoting cycling, including by setting standards (e.g. on how roads should be built to allow a safe use by vulnerable road users; on what should be considered a "safe" bicycle, as opposed to "toys", as bicycles continue to be perceived), changing policies, providing incentives (e.g. to employers to provide shelters and services for cyclists; to public transport to support inter-modality; to owners of apartments to change condominium blocks regulations and where possible to develop secure shelters) and disincentives (e.g. road pricing and parking policies to discourage the use of cars). For private organizations there is an interest in developing products that meet the demand for secure shelter, safety devices, comfortable yet fashionable clothing, tourism services, chains of shops, hotels, restaurants and other amenities which are "friendly to cyclists".

8. **An approach for an integrated promotion effort by the relevant public and private organisations.**

A tiered approach seems to be the best way of developing the series of interventions and actions (going beyond social marketing) that are requested at different levels of administration to cope with the issue. Please refer to the report http://www.thepep.org/en/workplan/urban/documents/HCsinputtoCyprus.pdf, which provides an overview of the main outcomes of a workshop on "Integrating Healthier Local Transport With Sustainable Urban Planning" which took place as part of the latest conference of Healthy Cities.

Again from a public health perspective, there can be new and interesting entry points and opportunities offered by the strengthening of cross-sectoral action to address the global epidemic of non-communicable diseases, and of environmental-related issues among children importantly, through the implementation of the "Global Strategy on Diet and Physical Activity" (see http://www.who.int/dietphysicalactivity/en/) the "Children's Environment and health Action programme for Europe (see http://www.euro.who.int/budapest2004) and the "Transport, Health and Environment pan-European Programme" – THE PEP) (see http://www.thepep.org).

ANNEX 2 - Cycling and Democracy

Enrique Peñalosa, former mayor of Bogotá[14]

The first article in any Constitution states that all citizens are equal before the Law. As a consequence, public good must prevail over private interest. Democratic urban design should reflect this.

Safe mobility is a basic human right. Citizens have a right to go out of their homes, move safely about their neighbourhood and their city, go to work, or to buy food. In a democracy the right to safe mobility cannot be restricted to those who have access to a motor vehicle.

Cycling is natural human mobility. It could almost be described as a more efficient way of walking.

In many countries bicyclists are not allowed on certain roads, such as high velocity roads. Bicyclists have a right to a well protected space in all roads, or in immediate parallel roads connecting points in an equally straight, level and unimpeded way as roads provided to motor vehicles.

In cases authorities do not allow tri-cycle taxis to operate in ordinary streets, arguing safety considerations. Yet there also are many streets where lack of quality pedestrian facilities makes walking risky. The democratic policy decision would not be of course to ban walking, but to require construction of adequate pedestrian facilities. The same is valid for bicycles and tricycles, private or commercial: If lack of bike-ways makes it dangerous to use bicycles and tricycles, the democratic response is not to ban them, but rather to require the necessary infrastructure to allow their safe use.

Protected bicycle-ways are necessary not only for bicycles; they allow safe mobility to wheel chairs as well.

For 5000 years city streets were safe for pedestrians. Horses and horse-drawn carriages were a nuisance but not a death threat to pedestrians. When motor-vehicles appeared, pedestrians were displaced from streets and confined to narrow sidewalks.

Bicycles only appeared as motor-vehicles had already taken possession of street spaces. Only few countries have built adequate infrastructure for them. In democracy, the Law must require all roads, both urban and rural, to have well protected bicycle-ways. The Law should also allow to establish tolls, or to increase existing ones, or to levy other specific taxes in order to comply with the mandate to have bicycle ways on all roads and streets.

While everyone can benefit from using a bicycle, most cyclists in developing countries are low income citizens. Making it safe and convenient to use a bicycle is thus sound social policy. Most citizens in developing country cities do not have a car. They have to use public transport; walk; or bicycle. For many poor citizens public transport is very expensive; and often inaccessible. In a middle income developing country city such as Bogotá, bus use can

[14] www.porelpaisquequeremos.com

take from 13% to 26% of a minimum wage earner's income. That assumes exclusively work trips for one person. Bicycle use over 20 years generates enough savings to buy a house.

The only form of individual mobility accessible to most citizens is the bicycle. Yet even when only a minority of the population owns a car, road infrastructure is built exclusively for the small higher-income minority which drives a car. This is not democratic urban design.

Urban Design

For massive bicycle use to occur, it is not enough to provide bicycle ways. The whole city structure must be amenable to bicycle use. Low density suburbs with long distances from homes to attraction points such as jobs or shops are not bicycle friendly even if bicycle-ways are built in all streets. A bicycle friendly city is compact, and has many attraction points near homes, ideally mingled in the residential areas.

Often it is claimed that it is not possible to fit roads with bicycle-ways because there is not enough space. A more humane and democratic way of approaching the issue would be first to take the necessary road space for pedestrians and bicycles and only then see how much is there left for motor-vehicles. If there is space for cars, there is space for bicycles. Pedestrians and bicycles have as much right to road space as motor-vehicles. Where a majority of the population has access to bicycles but not to cars, bicycles must have priority over motor-vehicles in the use of road space.

Particularly if there is space for parking a car on a street, there is space for an ample bicycle-way. Parking is not a constitutional right anywhere, whereas the right to safe mobility on a bicycle is or should be.

Tens of thousands of bicyclists are killed every year throughout the world. 447 bicyclists were killed in Colombia in 2004. Governments are fully responsible for each and every cyclist killed in a road or street lacking a physically protected bicycle way. A road without pedestrian and bicycle infrastructure is evidence of lack of democracy. Physically protected pedestrian spaces and bicycle-ways are not something nice to have: having them is a basic human right.

For citizens to exercise their basic right to safe mobility, the Law, ideally at a constitutional level, must require quality pedestrian and bicycle infrastructure in all urban and rural roads.

The greatest challenge of social organizations in developing countries is to achieve legitimacy: Citizens' confidence in the fundamental justice and integrity of their social organization and their State. In order to achieve legitimacy, public good must prevail over private interest. Priority must be given to solving the needs of the majority, particularly of the poorer majority.

Bicycle ways are a means to construct equality as they make safe mobility possible to many or those citizens who do not have access to a motor vehicle, such as children and low income citizens. In developing country cities where most citizens do not have access to a motor-vehicle, bicycle ways are a basic element of a democratic urban infrastructure.

At a traffic light, the relationship between a citizen on a crowded bus and one on an expensive car reflects inequality. It is very different to that of two citizens on bicycles next to each other at the same light.

Bicycle riding also creates closeness, solidarity, human contact. We humans enjoy looking at others, being close to others and that happens when we ride a bicycle. As it happens in public pedestrian spaces, bicycling spaces allow us to be close to many different people.

Many cars on a given urban area are no indication of quality; while many bicycles are evidence of quality of life.

Social Status

The main obstacle to bicycle use in developing countries is their social status: They are identified with the poorer members of the population. An important challenge is to raise the bicycle's social status. Among the ways to achieve that are the following:

- The most important way to elevate the bicyclist's status is to build specialized infrastructure: Physically protected bicycle-ways, well painted, with quality road signaling, ideally bicycle traffic lights and such. As much as possible bicycle ways must have priority of way over motor cars; traffic regulations must do likewise. Bicycle parking facilities must be mandatory in any private or public parking facility.

I would propose that 20% of the bicycle-way's importance is that it protects the cyclist; and 80% of its importance is due to the fact that it symbolizes that a citizen on a $30 bicycle, is equally important to one on a $30,000 car.

Every small detail of the bicycles' infrastructure reinforces their status: signs; parking; lights; quality of the pavement. The quality of a bicycle-way is directly proportional to the quality of the ride, but also to the status it provides bicycle riders. A formidable, tree-lined, well illuminated bicycle-way, through the most central and commercial areas of a human settlement, makes it irresistible for most citizens to use it.

- If the Mayor and other high level government officials use bicycles often, it gives status to riding bicycles. Government institutions can institute "bicycle days" in which employees are not allowed to park in the premises and are encouraged to take ride bicycles. It is very useful to get some well known artists to ride bicycles, or for the star character in a soap-opera to ride a bicycle. It is useful to create a bicycle-mounted police force, with nice bicycles and good looking uniforms.

- "Car Free Days" in which bicycle use is promoted are useful. Bogotá, a 7 million inhabitant city established an annual Car Free Day through a Referendum, the first Thursday of every February; no private cars can be out in the street that day. Every Sunday Bogotá holds the "Ciclovía", in which 120 kilometers of main arteries are closed for 7 hours for citizens to go out on bicycles, jog or simply go out walking. This attracts more than 1.5 million people every Sunday and promotes bicycle use.

- Advertising campaigns, mainly on television and radio, can be useful for elevating the status of bicycle use.

Rural Areas

Developing countries have large, some times larger than urban, rural populations. Intercity roads are not only means to link urban centers. They are the basic local road for rural communities. They are used by children to go to school, by poor farmers to bring their products to market or to go to their fields. Low income farmers, rural workers and children endure great risks when they walk or bicycle on such roads. When roads are not paved, motor-vehicles velocity is relatively low and thus there is not so much danger to bicycles and pedestrians. Once paved, roads without protected bicycle and pedestrian paths are

extremely dangerous to pedestrians and cyclists. The Law must require all paved roads to have well protected paths for pedestrians and bicycles.

Bicycles are so important in rural areas that a special narrow path for bicycles could be paved on the non-paved road, protecting it of course from being used by motorized vehicles. Another possibility in rural areas is to build narrow paved paths across fields and alongside mountains, exclusively for bicycles. In mountainous areas carving out a bicycle road requires a narrow cut, much less costly than the large cut necessary for a motor-vehicle road.

Economic development and bicycles

If citizens can save money biking to work and school, they can invest in better housing, small businesses, education and electronic gear such as cell phones or computers that will make them more productive. If citizens are healthier because they ride bicycles, they are more productive and health expenditures are lower.

Rural bicycle infrastructure facilitates bringing products to main roads and then to markets. It makes possible for workers to reach their places of work and for many children to attend school.

A city structured for bicycle use will save on road construction and maintenance; on car depreciation; on fuel. It will thus have lower costs and be more competitive.

A city for bicycles is a humane city, with quality of life. Quality of life makes a city attractive to highly qualified and creative people and thus to investors.

The Bogotá Experience

With nearly 7 million inhabitants, Bogotá was a typical large developing country city, with terrible traffic-jam problems and a feeling of hopelessness among the population. There were almost no public spaces, parking bays had been carved in most sidewalks or cars simply parked on sidewalks. As car numbers grew more flyovers were built and a JICA (Japanese International Cooperation Agency) even proposed a $ 550 million elevated highway through the center of the city. Public transport was totally chaotic, with almost individually owned buses racing crazily against each other for passengers, blocking traffic, dumping passengers in the middle of main roads. Bicycle use was extremely dangerous and the number of cyclists insignificant.

It is then that a radically different urban model was adopted and began to be implemented. More than 1200 parks were built or re-built. Some central streets were made pedestrian only and a new 17 kilometer pedestrian street was built through low income neighborhoods. Car use was severely restricted: 40% of all cars must be off the streets during peak hours. A Car Free Day was adopted through a referendum, banning all cars from city streets the fist Thursday of every year. Tens of thousands of cars were removed from parking bays and sidewalks and quality sidewalks and bicycle ways were built. A very high quality bus-rapid-transit system called TransMilenio was put in operation, saving hundreds of hours annually to more than 1 million daily riders; many more lines are programmed for the future. And more than 350 kilometers of protected bicycle ways were constructed.

Many means were used to promote bicycle use. Today more than 4% of the population use bicycles to go to work and study. Bicycle riding acquired a much higher status. Before cyclists were seen as the poorest of the poor, a wretched nuisance to motor-vehicles. Today

they are much more respected and have a new self-esteem. Most cyclists wear helmets and reflective vests, as much as a sign of an increased status, as a means of protection.

Quality public pedestrian spaces are an integral part of TransMilenio. The purpose is to avoid the deterioration which often occurs next to transport facilities; and to attract passengers to the system. Most TransMilenio trunk lines have been fitted with parallel bicycle ways and there are several feeder bicycle-ways to stations. So far only one station has quality bicycle parking. In several others tricycle taxis bring passengers to the system.

Much has yet to be done to make Bogotá a bicycle friendly city. Thousands of kilometers of bicycle ways and tens of thousands of parking facilities have to be built. To start, all access roads to TransMilenio stations should have quality bicycle-ways. Ideally there should be parking facilities at the stations or near them. So far it seems that initially tri-cycle taxis will be more used than bicycles as means to reach TransMilenio. We dream of a Bogotá where the share of bicycles in total transport means reaches at least 20%.

Bogotá bicycle program has begun to be imitated in other Colombian cities. While Bogotá is high in the mountains and relatively cool, dozens of mid-size Colombian cities are tropical, level and bicycles could become the main means of transportation. However power structures are only beginning to make it possible for those cities to give as much importance to bicycle as it is given to motor-vehicles.

A very large study by the Colombian National Statistical Office found that bicycle paths were highly appreciated by Bogotá’s citizens. When asked in 2003 which public works had most improved the family’s quality of life, bicycle paths ranked second after parks with 68,6%, ahead of the much better known TransMilenio bus-rapid-transit system, which was mentioned by 64,8% of people polled.

ANNEX 3 - Cycling and Poverty Alleviation

Andrew Wheeldon, Bicycling Empowerment Network[15]

1. The importance of the social interest

Poverty alleviation can be measured in many ways. In a direct sense, one can talk of the financial alleviation of families through an increase in their income levels. This can be complemented by the improved health and general well-being of individuals, bringing about a lowering of their reliance on medicines and treatment. However, poverty can also be measured by the physical environment in which one has to live. This is affected by the quality of the air that one has to breathe, and the stress levels encountered on a daily basis. Poverty can also be measured by the degree to which individuals and communities feel connected to, and in control of, their destiny: to their local industry, decision making, and opportunities. Poverty can be measured by degrees of connectivity, which suggest forms of access to opportunity. For many communities, both rural and urban, a local identity, or sense of value, is critical to health and a sense of wealth. The bicycle is a mode of transport that can begin to address many of these concerns. Through providing a low-cost transportation alternative, it alleviates the direct financial burden of daily travel. It is a zero emission vehicle that does not pollute the environment. It also connects local people with each other in a friendly manner and facilitates their independence and ability to be in control of their lives and make a contribution to the lives of others.

2. The contribution that cycling provides towards improving this social interest

The bicycle has been described as the greatest invention of the 20th century. From a human mobility perspective, its impact is felt as a far lower cost to the environment and the end user than other forms of assisted travel. The bicycle provides us with greater alternatives to the way in which we view transport. From an energy expenditure point of view, it remains the single most efficient form of travel. From the perspective of a national form of transport, it has served as a remarkable invention: entire nations, such as China and India, have built their economies largely on the use of the bicycle. For countries such as these, with limited resources and a large working class population, the bicycle is oft the answer to the livelihood of many: it is the tool with which millions ply their daily trade, earn their daily wage and can feed their families. In countries where many people use bicycles, there is the added safety of a form of critical mass. Studies across the world have demonstrated just this: increased bicycle use can increase the safety of cyclists; for example in Melbourne, Australia (www.bv.com.au) and Britain www.bikebiz.co.uk.

‘Bicycles are not only thermodynamically efficient, they are also cheap. With his much lower salary, the Chinese acquires his durable bicycle in a fraction of the working hours an American devotes to the purchase of his obsolescent car. The cost of public utilities needed to facilitate bicycle traffic versus the price of an infrastructure tailored to high speeds is proportionately even less than the price differential of the vehicles used in the two systems. In the bicycle system, engineered roads are necessary only at certain points of dense traffic,

[15] www.benbikes.org.za

and people who live far from the surfaced path are not thereby automatically isolated as they would be if they depended on cars or trains. The bicycle has extended man's radius without shunting him onto roads he cannot walk. Where he cannot ride his bike, he can usually push it.' (Energy and Equity, Ivan Illich: Toward a History of Needs. New York: Pantheon, 1978.)

3. The specific (added) value of cycling relative to alternatives that can serve this social interest

The bicycle, relative to other forms of transport, is low cost – both as an initial cost and as a long-term running cost. For a small investment, one is rewarded with a form of transport that brings a unique form of independence and practicality. Studies in many countries support this view. In South Africa, it was found that low income earners were spending 25% of their income on public transport to and from their place of work; with the purchase of a low-cost bicycle, after the initial purchase cost of the bicycle, this reduced to 5% after three months. In a further project in South Africa, a rural health care program was able to increase daily patient care from 8 to 19 after changing the mode of transport of the care givers from walking to cycling (see www.benbikes.org.za).

A bicycle is also easy to maintain and repair. It follows that it is also easy to teach recipients how to repair and use bicycles, and by so doing an entire market and industry can be established. It is not necessary to construct large factories: for a small investment, local workshops can be established and the needs of local commuters can be met. This furthers the ideals of densification of communities and supports the quest for 'local solutions for local communities'.

In poorer countries, with limited access to funding for the establishment of road infrastructure, the promotion of cycling makes good sense. Bicycle paths requires less investment for construction (about 25% of the cost for motorised traffic) as the paths are both narrower and require fewer layers of supporting road structure, since the bicycle is much lighter than the motor car. It makes both financial sense, and from a human, health perspective. Furthermore, cycling as a form of transport (due to the distances that can realistically be covered) encourages the localization of economies and promotes high density living; which in turn, it can be argued, slows the move towards globalization and urban sprawl. It is highly efficient as a source of transport for distances between 2 and 8 kilometers, a range which encompasses most daily trips taken in a city or town.

4. The target group (segment) within the population of road users for which the social interest is most relevant

Cycling provides a source of transport for all and knows no boundaries in terms of race, religion, economic status, health or gender. However, due to its very nature, it is more widely used as a source of transport for those in the lower socio-economic groups. In terms of access, it is precisely those that have the least access to motorised forms of transport that are most likely to use bicycles. This has direct implications for the status of bicycles. It is widely perceived as a form of transport for the young or the poor – both groups, incidentally, who have little or no access to their own private cars. It follows that the reason for this is not based as much on choice as on a lack of choice: there is a perception that almost everyone would choose to drive a car rather than ride a bike, given the opportunity. It follows that there are perhaps three target groups here: there are those that are already cycling, who are further divided into two groups: those that wish to and those who have no choice but to; and those that do not cycle at all.

For the first group, the social interest in cycling is due to the fact that they have embraced cycling and its benefits. This group needs to be supported and given a voice so as to encourage others and to effect change. For the second target segment, or group, one needs

to bring about a realisation that the correct choice has perhaps already been made, even it appears that is has been made due to a lack of choice. There are many reasons for this being considered the correct choice, which has been dealt with above; the alternative comes at far greater financial and environmental cost. The final segment has many parts to it, based mainly on the differing reasons for not cycling, and these factors require many different strategies. But this target group is important and one in which the social interest in most relevant. Those who do not exercise regularly can gain much from embarking on this form of travel in terms of their health. For those who struggle financially to commute, or who walk long distances, the bicycle makes for an effective alternative.

5. The (potential) demand for cycling by the selected target group of road users, and the obstacles that prevent them from currently using the bicycle

The potential demand for cycling as a low-cost alternative is significant. Low income levels that exist in many areas have the effect of denying families access to opportunities, particularly in areas with large urban sprawl. The potential for bicycle use is large; but this is diminished by many factors, or obstacles. A lack of road infrastructure (to enhance bicycle safety) and storage facilities deter many from using bicycles. An increase in the origin-destination *proximity* has the effect of supporting bicycle travel, by creating an environment whereby many live close to their places of work and school. Travel distances become more manageable. In South Africa, for example, those who are financially *most* in need of living in close proximity to work and school tend to be those who live far away, in remote and isolated 'townships'; as a result many are reliant on costly motorised forms of public transport.

Linked to distance and environment is the question of safety and security. Longer distances suggest that busier, more direct roads (with fast, motorised traffic) need to be used by those on bicycle. These transport corridors are more geared for motorised traffic, including the infrastructure in respect of wider lane width, interchange system and access to and from the road system. This is usually suitable for cars, but highly unsuitable for bicycles. There needs to be a better system for promoting the bicycle as an integrated form of the public transport strategy.

6. Given the potential for cycling promotion, identify the cycling product that matches the demand of the target group to eliminate at least some obstacles to cycling use

The status of the bicycle can be a deterrent to the cause. As long as it is perceived as the travel choice of the poor, it will carry a low status. In truth, it is correct in this estimation – it is oft the travel choice of the poor, but it can also have a high status: these terms should not necessarily be mutually exclusive. Thus the product that primarily requires attention is the *status* of the bicycle. More specifically, it is the status of the *commuter* bicycle that needs to be improved and enhanced. This can be achieved through effective marketing of the bicycle, leading to increased brand awareness; in truth, it is perhaps the *lifestyle* of bicycle commuting that needs to be sold to the market – across all socio-economic groups. Inclusive to this model would be consideration for commuter clothing and style of dress, education in traffic safety, encouragement programs, formation of clubs and 'cycling buses', and greater research into bicycle design. This needs to occur simultaneous to a restructuring of the transport system so as to effectively integrate the bicycle into the daily travel pattern.

7. The product specifications for the different public and private organisations to address the potential demand

For the above product(s) to be successfully achieved, a multi-faceted approach is necessary, including the input and leadership of a wide range of role-players. Many of these role-players will be required to leave aside personal agendas and become partners in this new plan, a role which is most difficult to coordinate. However, it is entirely necessary, for this is more

than simply a restructuring of modes of transport – it involves a paradigm shift of how human travel is viewed and, perhaps more importantly, sold and marketed. Both the public and private sectors need to be involved – through policy to facilitate the use of bicycles and incentives to encourage its usage, and a strong commercial interest in the profits to be made respectively. Education bodies and bicycle user groups need to be mobilised into the strategy: an examination and successful implementation of the education, encouragement, environment, engineering and enforcement of both bicyclists and non-bicyclists. If cycle commuting can be seen as both an effective low-cost alternative (securing the advocacy of low-income families) and simultaneously as a high-status, glamorous travel choice (bringing attention from many other sectors) then the probability of success is high. The delicate balance of these two paths is the critical factor.

8. An approach for an integrated promotion effort by the relevant public and private organisations.

Bicycling is a more humane, redistributive, and communal form of transport. Bicycling is emission free, resulting in a reduced probability of climate change; this can be directly linked to poverty alleviation. When rivers become polluted by effluent, it is the wealthier classes that can afford to obtain drinking water elsewhere; whereas the implication for the poor is that the probability of ill-health increases. Increased health of all results in increased productivity and, it follows a reduction in poverty. As mentioned above, this requires a multi-faceted approach of many different partners in a solid and strategic partnership. An integrated transportation plan that is both efficient and low-cost can be achieved through the successful implementation of the above strategies.

ANNEX 4 - Cycling to work

Hugo van der Steenhoven, Fietsersbond, the Netherlands[16]

1. The importance of social interest

In the Netherlands we have a great problem getting to work by car. Every day there are long tailbacks on the Dutch roads. We have 17 million people and car possession has increased enormously. More than 7 million cars and the expectation is 9 million in 2010.
Beside the traffic jams, we suffer from air pollution, PM10, NOx. Another problem concerning car use is that we have to deal with is the inactivity of many people and their growing weight.(obesities). Companies see the impact of these problems in illness figures of their workers.

2. The contribution of cycling

When people cycle more to there jobs, there will be less traffic jams, less illness, less discharge of emissions. At this moment in the Netherlands 1 million people already go by bike to their job. More than 70% of all car trips are shorter than 7,5 kilometres. When we know what the reasons are why many workers go by car and not on their bike to work it must be possible to start a campaign with the right arguments to get more workers on their bike.

3. The (added) value of cycling to work

In the past years the Dutch government has tried enormously to persuade companies to do more to get their workers to use public transport (bus and train) or to carpool to work. It was not a great success. Employers did not find it their responsibility to work together with the government to solve the problems concerning car use and pollution.
So the project of the Fietsersbond has to convince employer's and employees that it is in their interest tot support cycling to work. In this project we have to search for reasons why workers don't use a bicycle to go to work. If we find this reason we can make a cycling strategy to promote cycling to work

4. The target group

Employees and employers of four greater companies in the Netherlands join us in a pilot, to search for obstacles why employers do not cycle to work. Through interviews with employers we try to find the reason why employees go by bus, car or bicycle to work. At the same time we investigate the cycle routes to the companies, the parking facilities for bicycles as well in the neighbourhoods as on companies facility.

5. Potential demands for cycling

[16] www.fietsersbond.nl

Through our pilot project we want to now the reason why many workers do not use the bike for commuting to work and we also want to know why others do the opposite. Is it because it is faster by car, easier by public transport, or because there is no safe bicycle path, or is it because you can't park jour bike safely at your front door?

6. **How to eliminate some obstacles to cycling use**

When we know the arguments of the employees and the employers of our four companies why people do not go by bike to their job, we are able to find answers and solutions. For example, maybe many workers say there is no bicycle shed near their firm and their bike will be destroyed within a year when he is standing outside. When you want these people on their bikes, as company you have to build a good bicycle shed.
Maybe the problem is the unsafe (bicycle) road to the factory. The local government is responsible for good and safe bicycle facilities

7. **Who has to do something to improve cycling to work**

The local government and employers have to stimulate cycling to work, it's better for the health of the workers, there will be less people who are overweighed, there will be less health costs and its better for the environment because of less pollution and less congestion on the main roads. When the (local) government and the companies do nothing, in a few years the problems of health, pollution and tailbacks will be enormous.

8. **Promotion for relevant public and private organisations**

When we have the results of the interviews, the investigation of the routes, the situation in the neighbourhood and around the working buildings, we are able to contact more companies in the Netherlands with the same approach. The Fietsersbond will advise companies what is the best way to get their workers on bike