



High Quality Cycle Infrastructure

Annex A of the Handbook 'Navigating Transport NAMAs'

TRANSfer Project – Towards climate-friendly transport technologies and measures

The concept

Cycling is a sustainable form of travelling. Non-motorised modes are often neglected in transport planning and strategies. This is unfavourable, since increasing shares of cycling can considerably contribute to GHG emission reduction, especially in urban areas. Comparing cycling patterns in different cities Rietveld (2001) assumes that trip distances of up to about 7 km are attractive for cycling. Other authors (e.g. Dekoster and Schollaert, 1999) assume lower distances of up to 5 km. Indeed, a large proportion of trips made by car are below 5 km. For instance, in Europe 30% of the trips are less and 3 km and even 50% cover distances below 5 km (Dekoster and Schollaert, 1999). Thus, there is a huge potential to substitute short-distance car trips by cycling.

Elements of high quality cycle infrastructure:

- Invest in high quality bicycle infrastructure, including bicycle highways
- Introduce bicycle sharing systems
- Provide bike and ride (B+R) facilities

For more details on the elements' characteristics see Box 1.

Table 1: GHG reduction matrix of high quality cycle infrastructure

	Avoid	Shift	Improve
Direct effects		<ul style="list-style-type: none"> ☑ Attracts motorists to use a bike for short distance trips ☑ Substitution of longer distance trips by a combination of low carbon modes 	
Indirect effects	<ul style="list-style-type: none"> ☑ Supports a dense city structure and can limit urban sprawl 	<ul style="list-style-type: none"> ☑ Increases the accessibility of public transport (PT) 	<ul style="list-style-type: none"> ☑ Can improve the efficiency of the PT system by increasing the occupancy rate
Rebound effect		<ul style="list-style-type: none"> ☒ PT trips are substituted by cycling, leading to reductions in the economic efficiency of the PT system ☒ Bicycle use and parking can adversely effect walking conditions 	
Complementary measures <i>(to achieve full mitigation potential)</i>	<ul style="list-style-type: none"> ☑ Dense and transit-oriented urban development (see Factsheet 'Dense and Transit-oriented Urban Development') ('city of short distances') 	<ul style="list-style-type: none"> ☑ Road traffic regulation (see Factsheet 'Economic and Regulatory Instruments for Road Traffic') ☑ Parking management (see Factsheet 'Sustainable Parking Management') ☑ 'Public Transport First' Strategy (see Factsheet "'Public Transport First' Strategy") ☑ Sustainable fuel pricing (see Factsheet 'Sustainable Fuel Pricing') 	

On behalf of

Box 1: Possible elements of high quality cycle infrastructure

Invest in high quality bicycle infrastructure (including bicycle highways)

A cycling network has to fulfil several key requirements to offer an attractive alternative to vehicle travel (Godefrooij *et al.*, 2009):

- **Connectivity:** avoid interruptions in the cycle network, but connect all origins and destinations through cycle tracks.
- **Directness:** shorten distances and reduce travel time as much as possible.
- **Safety:** design the cycling network in a way that maximum safety is obtained.
- **Comfort and attractiveness:** provide appropriate surfaces for cycle tracks, minimise stops and waiting times at intersections and offer sufficient bicycle parking facilities.

There are different kinds of cycle tracks (e.g. separated of other modes or shared lanes). Bicycle highways are clearly marked bicycle tracks that are separated from motorised traffic and that provide direct connections on the main routes, which are easy to follow. It is necessary to identify the most suitable type of cycle track for each road section.

How it works and intended effects:

- Enable a substitution of short- distance car travel;
 - ➔ Shift from vehicle travel to cycling.
- Increases the attractiveness of cycling and offers a cost-effective and time-saving travel alternative;
 - ➔ The modal share of cycling is increased.

To be considered for implementation:

- Constructing cycle tracks needs considerable financial investments. However, it is less costly and time consuming than additional car infrastructure.
- Some improvements can be realised in shorter terms, such as cycling-friendly traffic light signals.

Responsible actor: Local transport planning departments

Introduce bicycle sharing systems

Bicycle sharing systems provide free or low-cost bicycles for public use. People can rent a bicycle for single trips or for a longer period. These systems are a suitable supplement to the local public transport system, especially in urban areas. Rented bicycles cannot only substitute short vehicle travel, but also improve the access to public transport and thus can increase its ridership.

How it works and intended effects:

- Offer a low-carbon transport alternative to commuters, tourists or people who do not own a bicycle;
 - ➔ Shift to cycling for short-distance trips.
- Improve the accessibility of public transport;
 - ➔ Substitution of long-distance trips by combining different low-carbon modes.

To be considered for implementation:

- Initial investments for bicycles and rental system required.
- If bicycle use is charged, revenues can be generated.

Responsible actor: Local transport planning departments

Provide bike and ride (B+R) facilities

The combination of cycling and public transport is an optimal low-carbon intermodality for longer trips. For many routes, public transport alone is not a good substitute for the private car. To encourage people to cycle to public transport stops, secure bicycle parking at stations has to be provided. Sheltered and guarded bicycle facilities provide the best parking options.

Some users need their bike on the way to the public transport station as well as from the station to their final destination. Enabling bicycle transfer on public transport vehicles can encourage these users to shift to cycling for access and egress trips.

Buses can be equipped with bicycle racks and bicycle transfer in rail system can be easily facilitated if space in the vehicles is dedicated to bicycles.

How it works and intended effects:

- Improved accessibility of public transport
 - ➔ Encourage a shift from car to intermodal low-carbon transport
- Offers an alternative to the private car for access and egress trips
 - ➔ Less car travel and parking at public transport stations

To be considered for implementation:

- Bicycle parking facilities can be installed; over time additional improvements can be made (e.g. sheltering)
- Enabling bicycle transfer in public transport vehicles requires investments in the vehicle fleet (additional wagons or devices)

Responsible actor: Local transport planning departments

GHG mitigation effect and co-benefits

The provision of a high quality cycle infrastructure is a very cost-effective measure to reduce GHG emissions. Analysing the effects of constructing bicycle tracks in an imaginary city with 10 million passenger trips each day, Wright and Fulton (2005) show that mitigations costs would attribute to USD 14 per tonne of CO₂. In their scenario, 300 km of cycle ways are build in the city at costs of USD 100 000 per kilometre. The authors assume an increase in the bicycle mode share from 1 to 5 %, whereby the share of cars, public transport and walking is slightly reduced. This results in GHG emissions reductions of approximately 3.9 % compared to the reference case without cycling infrastructure. A further expansion of the cycle network (up to 500 km of cycle ways) and additional promotional campaigns can even increase the mode share of bicycles to 10 % and would lead to 8.4 % GHG reduction. The largest reduction potential was identified for a policy packages that bundles public transport, cycling and walking improvements (see Factsheet “Public Transport First Strategy”).

Co-benefits of an increased share of cycling in urban passenger transport are:

- Net economic benefit from cycling investments due to fuel and health care cost savings;^[1]
- Easing of the overall traffic situation (less congestion) and more efficient use of road space (reduced demand for road and parking infrastructure);

- Additional indirect economic benefits from congestion relief, increase in real estate values, and road infrastructure savings;
- Improved mobility options for low-income families that cannot afford a car or frequent public transport use;
- Improved road safety if a critical mass is reached.^[2]

Towards implementation

The measure targets primarily short-distance travel patterns of motorists. Trips from home to work or to school are targeted as well as leisure and smaller shopping trips.

Key stakeholders

- Local transport planning departments: Ideally responsible for the bicycle network and associated infrastructure; pave the way for bicycle-sharing systems;
- Local land use planning departments: Consider cycling infrastructure in urban development strategies and ensure that sufficient road space is reserved for cycle infrastructure;
- Local public transport operator: Can operate bicycle sharing systems and is involved in the implementation of B+R facilities.

^[1] It was found that the city of Portland could reduce its GHG emissions by 2040 by 0.73 million tonnes of CO₂, with a net economic benefit of USD 1.2 billion from fuel and health care cost savings if the city invested USD 7 per resident each year in the cycling infrastructure (Winkelmann *et al.*, 2009).

^[2] In cities with a high share of cycling and walking, road injuries by cyclists are considerably reduced (Godefrooij *et al.*, 2009).

Table 2: Potential barriers to implementation of a high quality cycle infrastructure (following Godefrooij *et al.*, 2009)

Barriers	Options to overcome
Concerns about personal security	<ul style="list-style-type: none"> ■ Ensure that the main bicycle infrastructure is in well lit areas with a maximum use; ■ Avoid underpasses if possible; ■ Introduce bicycle police patrol especially in remote cycling areas; ■ Create liveable streets that invite people to meet each other in public spaces.
Poor road safety	<ul style="list-style-type: none"> ■ Limit the speed of motorised vehicles; ■ Strict enforcement of traffic laws; ■ Increase the visibility of cyclists in the street and avoid obstacles especially at crossings; ■ Separated bicycle lanes provide a greater sense of safety; ■ Start with the renovation and building of high quality cycle infrastructure in the area of schools and universities; ■ Cycling classes at school to teach children traffic rules and correct behaviour.
Climatic and topographic inconvenience	<ul style="list-style-type: none"> ■ Tree planting and special pavements can reduce heat on bicycle tracks; ■ Provision of washing and changing rooms at workplaces; ■ Electric bikes or bicycle transfer in public transport vehicles can help to overcome hilly terrain.
Cultural constraints (e.g. public perception of cycling as a low-status mode of transport)	<ul style="list-style-type: none"> ■ Implement bicycle promotion strategies (e.g. car free days, bike-to-work programmes); ■ Cooperate with civil society organisations to improve public perception; ■ Advertise cycling with high-status role models (e.g. prominent politicians that cycle to work).

Success factors

- Raising awareness for cycling;
- Improved perception of cycling among the political body and the public;
- Enabling stakeholder participation in the planning process;
- Continuous evaluation of the cycling conditions and rapid elimination of identified deficiencies;
- Close cooperation with bicycle user groups (they voice the interest of users and can help to identify problems);
- Close cooperation between local transport authorities and public transport operators to promote the role of bicycles in intermodal transport;
- Cooperation with local employers to encourage them to implement bicycle parking and changing facilities on the company grounds.

Practical example: CicloRuta in Bogotá

The city of Bogotá implemented one of the most extensive bicycle networks in the world within seven years. The network is called CicloRuta and covers 340 kilometres of exclusive bicycle lanes. The cycling system is divided into three sections: a main network

that connects the key city centres with the densely populated residential areas; a secondary network that links housing areas, facilities and parks with the main network and with the local public transport system; the third network links external and recreational routes to the systems. Furthermore, guarded parking facilities were built at main public transport stations.

The city administration of Bogotá spent USD 50.25 million on the development and construction of the CicloRuta network. One kilometre of the bicycle lane cost about USD 147 000 and additional USD 250 000 were spent for studies and the development of the initial design.

The CicloRuta resulted in an increase in bicycle trips in Bogotá. They rose from 0.2% of the total trips in the City in 2000 to 4% in 2007. Seven years after the beginning of the project, the cumulative emission savings amounted to 36 803 tonnes CO₂ (in 2007 the annual savings were 6 449 tonnes of CO₂).

Furthermore, it is estimated that annual fuel costs to the public of USD 40 million are avoided (USD 480 per person). Despite the increase in bike use, the number of injuries suffered by cyclists has been reduced (C40 cities, 2010).

Further reading

- **C40 cities (2010)** 'Bogotá's CicloRuta is one of the most comprehensive cycling systems in the world' http://www.c40cities.org/bestpractices/transport/bogota_cycling.jsp accessed 11 September 2011.
- **Godefrooij, T., Pardo, C. and Sagaris, L. (eds) (2009)** 'Cycling-Inclusive Policy Development: A Handbook', GTZ, Eschborn, Germany.
- **Rietveld, P. (2001)** 'Biking and walking: the position of non-motorised transport modes in transport systems' in K. J. Button and D. A. Hensher (eds) Handbook of Transport Systems and Traffic Control, Pergamon, Amsterdam.
- **Wright, L. and Fulton, L. (2005)** 'Climate Change Mitigation and Transport in Developing Nations' Transport Reviews, vol. 25, no. 6, pp. 691–717.



Beijing, China – Photo by Manfred Breithaupt, 2006

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