Low-Carbon Land Transport Options towards reducing Climate Impacts and achieving Co-Benefits

Moving Africa Forward: Transport Policies for Growth and Integration-SSATP Annual Meeting 2010-18-21 October 2010
Manfred Breithaupt

GTZ – Water, Energy, Transport
Challenges in Urban Transport

Transport accounts for 13% of global GHG emissions; in developing countries energy consumption and CO2 emissions from transport are increasing rapidly.

E.g. in South Africa, 2007, Transport contributed to 16% of the country’s total CO2 emissions, with road transport producing 75% of transport emissions. Many developing countries experience the same situation.

Source: ITF data 2010
Transport CO$_2$-Emissions by Mode (2005)

Within the transport sector, road traffic is responsible for the largest share of emissions:

- **Road Traffic**: 73.0%
- **Aviation**: 11.0%
- **International Shipping**: 9.0%
- **Inland Navigation**: 2.0%
- **Rail**: 2.0%
- **Other Traffic**: 3.0%

Source: ITF/IEA
Top Emitters of CO₂ from Transportation, Total and Per Capita, 2006

Source: WRI, CAIT v. 7.0 (http://cait.wri.org) based on IEA, 2008. Adapted from Figure 12.4 in Navigating the Numbers (Baumert et al., 2005).
Long-term objectives

- Global warming limited to below 2°C in relation to pre-industrial times (before 1900)

- Tolerable 2 t CO₂ per capita and year over all countries

- Required reduction until 2050
  - in industrialized countries: 80-90 %
  - In developing countries: 50 %
Humans love to move, travel, discover... by different ways and modes...
In most cities, **mobility** is dominated by **personal motorized transport**. Many people choose **cars** to move around…
Road transport is a major contributor to **air pollution** and **climate change**. Transport contributes to **23%** of energy-related CO2 **emissions** and is still growing!
Worldwide, 1.2 Million **road deaths** and more than 20 Million **people injured** per year
10-25% of urban areas are taken by road transportation infrastructure a lot of space for cars but...
…where is the space for people?

the silent pedestrian, the invisible cyclist must be seen… and heard
There is an **alternative** to automobile dependency:

- Compact cities
- Mixed land use

Redesigning urban space

Sustainable transport modes:

- walking
- cycling
- public transport
We can simply share our space: pedestrians, cyclists, vehicles…

**public** and private, motorized and **non-motorized**
...we can even **reclaim** our space and **enjoy** the people’s mobility! making our cities full of **life** and **happiness**
Seoul, 2005: the City **tore down** 5.8 km of elevated **freeway** and exhumed a buried river…

less space for cars and **more space for people!**

**Before**

**After**

---

**Can you find the differences?**
Sustainable Low Carbon Transport …

- Increases energy security
- Reduces congestion and high public health costs
- Reduces land demand
- Increases international visibility and acknowledgement of cities that demonstrate leadership
- Opens new sources for funding (e.g. carbon related funding schemes)
- Enables political co-benefit: In London the popular major Ken Livingston was elected mainly because of his innovative transport policies.
Vision for a low carbon transport system

- **Dense** but **green** and **mixed** land use
- Modern, high quality links and **good integration**
- High quality **alternatives** to individual car-use, esp. efficient public transport and good non-motorized infrastructure and its proper integration;
- Efficient, inter-modal freight transport and smart urban logistics
- Vehicle and fuel efficiency
- Managing transport demand
Recent Achievements

✓ Bogotá
✓ Curitiba
✓ Copenhagen
✓ Zurich (#2, Mercer)
✓ Freiburg
✓ Vienna (#1, Mercer)
✓ Seoul
✓ Singapore (most livable city in Asia, Mercer)
✓ Hongkong

All of these successes featured an integrated and packaged approach:

1. High-quality public transport
2. Improved conditions for walking and bicycling
3. Effective integration of modes
4. Supportive land-use policies
5. Car-restriction measures
### CO₂ emissions from passenger transport vs. modal split: Selected cities

<table>
<thead>
<tr>
<th>City</th>
<th>Share (%) of public transport, walking and cycling</th>
<th>CO₂ emissions (kg per capita per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Houston</td>
<td>5%</td>
<td>5690 kg</td>
</tr>
<tr>
<td>Montreal</td>
<td>26%</td>
<td>1930 kg</td>
</tr>
<tr>
<td>Madrid</td>
<td>49%</td>
<td>1050 kg</td>
</tr>
<tr>
<td>London</td>
<td>50%</td>
<td>1050 kg</td>
</tr>
<tr>
<td>Paris</td>
<td>54%</td>
<td>950 kg</td>
</tr>
<tr>
<td>Berlin</td>
<td>61%</td>
<td>774 kg</td>
</tr>
<tr>
<td>Tokyo</td>
<td>68%</td>
<td>818 kg</td>
</tr>
<tr>
<td>Hongkong</td>
<td>89%</td>
<td>378 kg</td>
</tr>
</tbody>
</table>

Source: UITP
ASI - Approach

AVOID/REDUCE

Reduce or avoid travel or the need to travel

- Integration of transport and land-use planning
- Smart logistics concepts
- ...

SHIFT

Shift to more environmentally friendly modes

- Transport Demand Management
- Mode shift to Non-Motorized Transport
- Mode shift to Public Transport
- ...

IMPROVE

Improve the energy efficiency of transport modes and vehicle technology

- Low-friction lubricants
- Optimal tire pressure
- Low Rolling Resistance Tires
- Speed limits Eco-Driving (Raising Awareness)
- Shift to alternative fuels
- ...

1  2  3
1. GHG reduction through land use

*Example: Carbon footprints (residential emissions only) in different neighborhoods in Toronto, Canada*

High-density apartment complexes within walking distance to a shopping center and public transit: 1,31 tCO2e/capita

High-density single family homes close to the city center and accessible by public transit: 6,62 tCO2e/capita

Suburbs with large, low-density single family homes that are distant from commercial activity and public transit: 13,02 tCO2e/capita

How far can I travel on 1 ton of CO₂?

- Diesel Articulated Bus: 142,857 km
- NGV Bus: 62,500 km
- Diesel Bus: 66,667 km
- Diesel Minibus: 20,000 km
- Diesel Car: 6,993 km
- Gasoline Scooter: 10,204 km
- Gasoline Scooter: 15,625 km
- Bicycle: ∞
- Pedestrian: ∞

Source: GTZ Sourcebook Module “Transport and Climate Change”, 2007, based on Hook / Wright, 2002
Inefficient use of urban road
Corridor Capacity

(people per hour on 3.5 m wide lane in the city)

Mixed Traffic  
Regular Bus  
Cyclists  
BRT single lane  
Pedestrians  
Light Rail  
BRT double lane  
Heavy Rail (e.g. Hong Kong)  
Suburban Rail (e.g. Mumbai)

2 000  
9 000  
14 000  
17 000  
19 000  
22 000  
45 000  
80 000  
100 000

Source: Botma & Papendrecht, TU Delft 1991 and own figures
Vehicle Efficiency

- Gearbox with long transmission
- Gearshift indicator
- Engine stop at idling
- Smooth underflow
- Lower body
- Smooth covers
- Narrower low rolling resistance tires
- Latent-heat storage
- Light weight seats

Slide by Axel Friedrich
Breaking the Trend

Energy consumption and transport

<table>
<thead>
<tr>
<th>City</th>
<th>Modal share of walking, cycling and public transport</th>
<th>Average energy consumption per person (MJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athens</td>
<td>34,1</td>
<td>40,9</td>
</tr>
<tr>
<td>Geneva</td>
<td>44,8</td>
<td>48,8</td>
</tr>
<tr>
<td>Rome</td>
<td>43,2</td>
<td>43,8</td>
</tr>
<tr>
<td>Vienna</td>
<td>62</td>
<td>64</td>
</tr>
</tbody>
</table>

Cities which increased the modal share of walking, cycling and PT saw a decrease in the consumption of energy for passenger transport per capita.

Source: UITP
## National Level Policy Packages

<table>
<thead>
<tr>
<th>Policies</th>
<th>Basic Package</th>
<th>Advanced</th>
<th>Deluxe Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Removal of fuel subsidies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove incentives for non-sustainable transport modes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Fuel taxation above European minimum taxation level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Give incentives to travel less, use low carbon modes and purchase fuel efficient vehicles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Low carbon long distance infrastructure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earmark a considerable share of the transport investments in low carbon modes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Efficiency standards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulate car producers and correct market failures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Removal of car-oriented subsidies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e.g. for business cars in order to remove barriers for sustainable transport modes; replace with job-tickets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Incentive Programme for municipalities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>to set up TDM, public transport and NMT investments and integrated land-use and transport plans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Vehicle registration tax/ license auctioning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e.g. taxing fuel inefficiency or weight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Low-carbon fuel standards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incentivizing low carbon fuels, e.g. electric cars</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Research, Development and Demonstration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For fuel efficient cars, electric bikes, busses and smart public transit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area of Activity</td>
<td>Basic Package Minimum requirements</td>
<td>Advanced Package Standard approaches</td>
<td>Deluxe Package Premium low carbon approaches</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------------</td>
<td>--------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td><strong>1. Make roads people friendly</strong></td>
<td>• side walks</td>
<td>• pedestrian and bicycle short cuts</td>
<td>• Public bicycle scheme</td>
</tr>
<tr>
<td></td>
<td>• reduce barriers</td>
<td>• Diverse street environment</td>
<td>• Shared space concepts</td>
</tr>
<tr>
<td></td>
<td>• speed limits</td>
<td>• Trees along roads</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• bicycle lanes</td>
<td>• Separated networks for bicycles and pedestrians</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• pedestrian and bicycle short cuts</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2. Manage parking demand</strong></td>
<td>• Prohibit side walk parking</td>
<td>• maximum requirements for parking places for cars</td>
<td>• Reduce/limit number of parking spaces in urban areas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• minimum requirements for parking spaces for bicycles</td>
<td>• Zero parking in new developments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pricing for existing parking places</td>
<td></td>
</tr>
</tbody>
</table>

Local Level Policy Packages
## Local Level Policy Packages

<table>
<thead>
<tr>
<th>Area of Activity</th>
<th>Basic Package</th>
<th>Advanced Package</th>
<th>Deluxe Package</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
<td>Standard approaches</td>
<td>Premium low carbon approaches</td>
</tr>
</tbody>
</table>
| **3. Move to high quality public transit** | • public transit clean and convenient  
• Increase speed through priority signaling | • Integrated ticketing / fares  
• Information / marketing  
• Green procurement of vehicles  
• Bus-only lanes along high-density areas  
• High quality interchange  
• Level boarding, and off-bus/metro fare collection to speed up transit | • Comprehensive bus rapid transit system  
• Urban rail network  
• Full integration of PT and NMT  
• Full integration with land-use |
| **4. Provide inclusive information** | • Information campaigns | • Cooperation with companies  
• Car-sharing  
• Bike-sharing  
• Car free days | • Travel information (Web 2.0) |
| **5. Reap the benefits of technological advancement** | • clean fuels and vehicles | • ITS  
• Green procurement  
• Prioritization of PT and NMT | |
## Local Level Policy Packages

<table>
<thead>
<tr>
<th>Area of Activity</th>
<th>Basic Package</th>
<th>Advanced Package</th>
<th>Deluxe Package</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum requirements</td>
<td>Standard approaches</td>
<td>Premium low carbon approaches</td>
</tr>
<tr>
<td>6. Change the role of cars</td>
<td>• Speed limits</td>
<td>• Reduce investments for motorized traffic</td>
<td>• Limitation of access to city centers</td>
</tr>
<tr>
<td></td>
<td>• Physical car restrictions</td>
<td>• Low emission zones</td>
<td>• Congestion charge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ITS</td>
<td>• Advanced city toll</td>
</tr>
<tr>
<td>7. Reinvent mixed-used, high density cities</td>
<td>• Mixed land use</td>
<td>• Land use regulation</td>
<td>• Advanced integration of land-use and transport into planning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• TOD</td>
<td>• Accessibility of public transit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Green belts</td>
<td></td>
</tr>
<tr>
<td>8. Create/Live in urban spaces</td>
<td>• Wide side-walks</td>
<td>• Urban greening</td>
<td>• Adapted architecture</td>
</tr>
<tr>
<td></td>
<td>• Pedestrian areas</td>
<td>• Diversity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Small public places</td>
<td></td>
</tr>
</tbody>
</table>
3. Towards Transport NAMAs
(Nationally Appropriate Mitigation Actions)
Developing Countries Needs

An analysis of the transport chapters of 71 TNAs

- Cleaner Technologies: 40
- Public Transport Improvements: 36
- Emission / Fuel Standards, Technical Checks: 22
- Traffic and Demand Management: 13
- Biofuels: 8
- Non-Motorized Transport: 8
- Public Awareness: 6
- Economic and Fiscal Instruments: 4
- Land Use Planning: 4

Included in Annex 2 of the UNFCCC TNA Handbook

21 out of 71 analyzed Technology Needs Assessments do not have a transport chapter

Source: Bongardt/Schmid 2009
(Sustainable) Transport NAMAs
Nationally Appropriate Mitigation Actions

- When a new climate treaty is agreed, sustainable transport policies as listed above could be registered as NAMAs at the UNFCCC.
4. Selected GTZ Activities
Bridging the Gap- Initiative 
Pathways for Transport in a Post 2012 Process 
www.transport2012.org
Include transport in the climate agenda

Objective of the Initiative:
Integrate transport in the climate change negotiations
Website in 4 Languages serving 4200 members in 5 continents

www.SUTP.org (Chinese website: www.SUTP.cn)
Sustainable Urban Transport: Knowledge base

The key features of the Sourcebook include:

- A practical orientation, focusing on best practices in planning and regulation and, where possible, successful experiences in developing cities.
- Contributors are leading experts in their fields.
- An attractive and easy-to-read, colour layout.
- Non-technical language (to the extent possible), with technical terms explained.
- Updates via the Internet.

1. Institutional and Policy Orientation
2. Land Use Planning and Demand Management
3. Transit, Walking, Cycling
4. Vehicles and Fuels
5. Social Issues in Transport
6. Environment and Health
Financing Sustainable Urban Transport

The newest Module “Financing Sustainable Urban Transport” has been launched in August 2010.

Next Modules to be launched in November will be:
Urban Freight
Parking Management