Megacities
Traffic Chaos an Solutions

Approaches for sustainable urban mobility

Wien wächst - Verkehr
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Contents

1. Urbanisation and Traffic problems impacts, mobility behavioral change

2. Integrated Transport Planning
   • Slow modes, soft policies
   • Public Transport
   • Traffic optimized settlement structure

3. Good practices examples in Transportation, Transportation approach New Town Hashtgerd
Urbanisation growth

- Over 50% of world civilisation is living in cities
- Increasing in all countries
- Even in countries with stagnation and decreasing number of inhabitants

Increase of urbanisation rate in diff. countries

The Endless City 2007
Growth of population and traffic

- Growth of population
- Population density
- Settlement structure
- Growth of income
- Production methods/Trade relations
- ...

![Graph showing growth of use of automobiles, total population, urban population, and motor vehicle fleet over the years 1960 to 2010.](image)
Traffic mode and energy consumption in traffic

What increases is the distance travelled per person per year by main mode!

Comparison energy consumptions per trip


Figure 3: GHG emissions in the EU-27, by sector (1990 = 100)

approximately double by 2050

IPCC 2014
EU CO2 reduction target traffic 1990-2050: -60%
Egypt’s primary energy consumption has grown at an average annual rate of 4.6%, primarily from rapid urbanization and associated increases in demand for electricity and transport services.

Growing fuel subsidies that are equivalent to USD 20 billion in 2011, estimated to be 20% of Egypt’s state budget and 10% of its GDP.
German Transport Infrastructure – increasing follow-up cost

Modernity Change Infrastructure in Germany 1980 to 2007

Investment demand in German municipality road bridges 2013-2020: 1 bill. € per year!

Arndt 2013
http://www.difu.de/projekte/2012/ersatzneubau-kommunale-bruecken.html

Abrasion (by vibration) of roads by lorries

1 lorry (24 t) = 10,000 cars (1.4 t)

Source: ProgTrans AG, Basel 2009, from: Ralf Pagenkopf, GF Straßen.NRW (Bunzel (Difu) Pres. at BPPP, July 2013)
Traffic Impact

Traditional solutions in the West

Pic+Text: Prof. Emberger, TUWien, 2010

Pic.: suburbanpermaculture.org
• strong correlation between increasing land use and traffic behaviour
• Klaus Töpfer, United Nations Environment Programme (UNEP), said: “Tell me your spatial structure and I will say how high the fuel price was in the past.”
• assumption that distance (s) is constant was incorrect
• constant at long term time (t)
• relative constantly travel budget: Germany: ~ 85 min/day

Wrong interpretation of the relation:

\[ \nu = \frac{s}{t} \]

\[ \uparrow \quad \sim \text{const.} \]

\[ \downarrow \quad \sim \text{const.} \]
Increasing travel distances

- higher travel speed leads to higher travel distance thus increasing the distances between places of activities
- consequence mono-functional suburban settlements evolved

\[ v = \frac{S}{t} \]

\[ \text{Land use in region of Frankfurt/Main 1925 (above) and 1990 (below)} \]

\[ \text{“Infill” between the “Spokes” (after Lay)} \]
Energy intensity comparison

- Effect of increasing of distances and car-dependency: high fuel consumption per capita
- Decreasing of population density
- Attention: some side effects, e.g. Fuel price (compare Australia – USA)

(nach Newmann & Kenworthy 1989)
Fuel consumption and urban density

Source: Schafer and Victor (2000)
Integrated Transportation Planning

Integration

• **Vertical – planning level**
  from international level, country, regions till communes

• **Sectoral – departmental planning**
  regional and land-use planning, landscape planning, economic promotion

• **Horizontal – neighbourhoods**
  neighbouring planning areas

• **successful implementation in transportation planning:**
  – participation of all stakeholders (use the local creativity)
  – cooperation between planning authorities
  – flexibility of concepts
  – consistency among the measures
  – interdisciplinarity
  – continuous evaluation
Mobility and Space

ITP and land use

• short distances between different places of activity such as living, shopping, labour, leisure important for reducing traffic demand
• ITP aims at a balanced mixture of all these opportunities in high density settlements
• in particular a harmonic balance between the number of employees and employment opportunities is very important
  ➔ Improvement of mixed-use areas
  ➔ Promotion of jobs in short distance to the living areas

(Holz-Rau/Kutter et al 1995)
structural axes
transportation and land use

- structural axis
  - central lane: exclusive for brt
  - lateral lanes: slow traffic

- system
  - transportation and zoning
  - transportation and road system
  - transportation hierarchical network
District of short ways exp. Freiburg Vauban

- Re-cycling of land-use: former military barracks
- Area in cycling distance to city center:
  - dense
  - mixed use
  - quality green spaces
- End of tramline extension
- Natural water regime
- High „solar standards“
- Parking concentrated outside in two garages
Seoul, South Korea

Road remove

- Removed the Cheonggye Elevated Highway (5.6 km)
- Only for cares. 150 thousands cars per day
- Terrible traffic congestion and cause regional slum.
Seoul

Redesign the roads
• City Hall Square Reconstruction Plan

Before

After
Seoul, South Korea - Bus

Bus lanes

- Move the bus lane to the center

Different Categories of Bus

<table>
<thead>
<tr>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>From downtown to major district</td>
</tr>
<tr>
<td>Red</td>
<td>Connect Seoul and its satellite city</td>
</tr>
<tr>
<td>Green</td>
<td>Connect subway and nearby residential area / main bus line</td>
</tr>
<tr>
<td>Yellow</td>
<td>Circle belt roads in separated district</td>
</tr>
</tbody>
</table>
High Quality Public Transport
Berlin Germany – Integrated Network

- 24h integrated network

![Map of Berlin's public transport network](image)
CO2 emission & spatial consumption

Space consumption

CO2 emission per Pkm

Transportkapazitäten im Vergleich (Beispiel München):
218 Personen = 1 Straßenbahn = 2 Gelenkbusse = 145 Pkws

Qualität: MVG

MVG Verkehrsmittel

CO₂-Bilanz der MVG Verkehrsmittel:
Mit der Tram lässt sich der CO₂ Ausstoß reduzieren, im Vergleich zum Auto um mehr als 3/4.

Subway  Tram  Bus  Car
New Towns: Compactness, Intensification and Mixed use

- Gross population density in Iran’s towns is about **100 to 110 persons per ha**
- Hashtgerd New Town meets the targets: gross population density of **148 per ha**
- The gross population density for the Pilot Project “Shahre Javan Community” >**200 p/ha**
- Intensification promotes for an **effective public transport and efficient land use for energy supply**
- However, **quantitative approach is insufficient**, since it does not shed light on the living situations of the inhabitants or on the **qualities and attractiveness of the urban form and public realm**.

Source: Young Cities Research Paper Series, Volume 03, The Shahre Javan Community Detailed Plan Planning for a Climate Responsive and Sustainable Iranian Urban Quarter
Mobility Package for New Inhabitants

**Phases**

- **Phase 1**: Shipment of "Welcome Package" and Service Card
- **Phase 2**: Motivational Call
- **Phase 3**: Shipment of Information Material and Test ticket
- **Phase 4**: Deepening Conversation
- **Phase 5**: Shipment of additional Information Material

**Components**

- **Mobility Booklet**: Information on the city and its background, Institutions, Shopping, Public Transport, Foot & Bike, Car, Distance Travelling. Option to order more information using the service card.
- **Motivational Call**: Calling New Hashtgerdians who haven't sent back the service card. Intensive dialog about information demand.
- **Shipment**: Shipment of written or telephonic ordered information material and optionally Test-tickets, or other combined offers e.g. car sharing & public transport ticket, bike and public transport ticket.
- **Deepening Conversation**: Mobility advice: Questions, Offers, Wishes. Test-ticket users are questioned concerning their: Satisfaction, Wishes, Incitation, Need of further information material subscriptions.
- **Shipment**: Shipment of additional information material. Shipment of subscription form.

**Evaluation**

(on basis of first positive results of the ‘Arrive’ – Project in Munich)
“Neubürgerpaket” in Munich

New Citizen „Mobility Package“ as one measure of the “Arrive” project
(http://www.arrive.de)
- Shipment of information booklet depending on daily updated information from the municipality’s record section
- Aftercare/Sales measures

Results:
- New Citizen Booklet was used very often and recommended
- Information Requirement was very high (average of 10 additionally ordered information packs per household [80% with focus on public transport]

Impacts:
Pilot-Project 5,000 Inhabitants per year
- Reduction of car-km: 4.7 million
- Reduction of CO₂ emission: 700tons

Source: http://www.arrive.de/downloads/zp_pr08.pdf
Calculation Base: 5000 new inhabitants; 3.8 ways per day per new inhabitant; average trip length public transport 11.4 km; average trip length motorized traffic 27 km
Source: http://www.arrive.de/downloads/ep/ep_pr01.pdf
→ Decisive criteria is the spatial-horizontal integration

Levels/Parameters

4 BRT / LRT lines
for main inner city connection (centre, railway station, industry areas,...)
(2,000 – 30,000 Passengers/h)

8 City-Buses:
connection between quarters and centre
(1,000 – 4,000 Passengers/h)

9 Local quarter buses:
inner area access
temporally demand responsive service and flexible stops
(Midi/Minibus)

Taxi/car sharing
Route taxi
Call taxi
Normal taxi

Regional commuter traffic
Interaction to Karaj and Tehran by train
Regional buses

Catchment areas:
Minibus: 250 m
City-Bus: 250-300 m
BRT/LRT: 300 m

Network principle scheme
The urban future:
- 50% motorised traffic (PT, car)
- 20% Pedelecs
- 30% walk, bike
Mobility Behavioral Change

- Decreasing of car use and car ownership in younger age groups
- Use of public transport is increasing
- Increasing of use of sharing services (car sharing, ride sharing, rent a bike, ...)
- Number of car less households are increasing in inner city areas (exp. joint building ventures in München: 25% car households only)
- More flexible mobility pattern: in particular young urban inhabitants use less cars and combine flexible different transport services
- They are looking for suitable information services
- New mobility service with web and app support influencing the transport market

Institut für Mobilitätsforschung, 2011
Modal shift

Modal Split in der Zeitreihe 1976 bis 2008:
weniger zu Fuß, mehr mit dem Auto

Wege, Modal Split-Anteile in Prozent, Personen ab 10 Jahren (Quelle: DIW – Verkehr in Zahlen, eigene Berechnungen, bis 1990 nur Westdeutschland)

Germany 1976 – 2008 (until 1990: West-Germany only)

- Car driver
- Walking
- Car rider
- Bike
- PT
Multimodality and Walkability „Augmented Reality“

Walk 21 Conference 2013

Bey2ollak 2014
Flexible and self-organized Mobility

- User know what they want
- Let create them their own services

PROFESSIONELLE SERVICES
- Bikesharing
- Carsharing
- Taxi
- Public Transport

PEER-TO-PEER ANGEBOTE
- P2P-Bikesharing
- Digitale Schlosser
- P2P-Carsharing
- Digitale Zugangs- und Alarmsysteme
- Ridesharing
- Nutzerprofile mit Bewertungen

CONNECT

Best Practice

TRUST

P2P-Option

Enabler/Beschleuniger

Mobility and Space
Crowd Data Sorcing

- Traffic count via video stream
- Real-time measurement of traffic speed

Video Travel Count
Placemeter

http://placemeter.com/
Crowd Data Sourcing

- Interaktive Internet-Karten
- Karte zum Suchen und Hochladen von Informationen

Wikimapia

Open Street Map

Database Searching

http://wikimapia.org
New Participation Culture

„Co-creation“ for Sustainable Urban Mobility Plans
Smart cities – smart streets:

Charging stations & parking lot detection; digital lanes?

- Detection space use
- Electric vehicle and charging stations – interface between traffic and electrical grid
- Flexible space distribution
Automatisiertes Fahren

„Zero traffic accidents“

- Reducing car fleet in Germany from 43 mil to 4 mil (!) vehicles only are possible  
  Honsel 2013

- Land consumption for parking space in Urban Business Districts 41 big cities around 31% of whole space  
  Anderson et al. 2014

- But may be: Rebound effects, data security, legal issues

Sustainable urban mobility needs:
- High urban **density**
- Mixed used areas
- High density of **foot paths and bike lanes**
- High quality **public transport system**
- Adapted systems for other collective transportation systems (taxis, car sharing, call bus, ...)
- Restriction for **car traffic**
- High-tech versus “**middle-tech**” and durable solutions
- **Capacity building** for planers and stakeholders with special attention to the knowledge for interrelation between traffic and settlement structure
- **Public awareness** for promotion eco-mobility
- **Transparency** of planning and **participation** of all stakeholders
- Easy used **planning tools**
Thank you!

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