Current and future air quality in the historic city of Bruges (Belgium)

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i-SUP 2008
Innovation for Sustainable Production 2008
Mobility policy in Bruges

• Some History
  – Innovation
  – Quality of life in the centre
    • Noise pollution
    • Accessibility

• Measures taken
  – parking
  – speed restrictions
  – alternative modes
  – cycling
Evaluation of the local mobility plan:
Proportion of modal choice has changed

Evolutie 2004-2006: diverse vervoersmodi naar de binnenstad

- Inkomende auto's: -20%
- Fietsers: 5%
- Busgebruikers: 15%
Evaluation of the local mobility plan:
Inbound commuters: cars and cyclists

<table>
<thead>
<tr>
<th>Vervoersmiddel</th>
<th>2004 Totaal</th>
<th>%</th>
<th>2005 Totaal</th>
<th>% verschil t.o.v. 2004</th>
<th>2006 Totaal</th>
<th>% verschil t.o.v. 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto</td>
<td>3703</td>
<td>100%</td>
<td>3197</td>
<td>-15.80%</td>
<td>3078</td>
<td>-20.30%</td>
</tr>
<tr>
<td>Fietsers</td>
<td>4928</td>
<td>100%</td>
<td>5001</td>
<td>+1.5%</td>
<td>5195</td>
<td>+5.2%</td>
</tr>
</tbody>
</table>

% verhouding 2004

- Fietsen: 43%
- Motorvoertuigen: 57%

% verhouding 2006

- Fietsen: 37%
- Motorvoertuigen: 63%
Evaluation of the local mobility plan:
Evolution of public transport (diesel buses)
Context of this study

• Innovation
• Air quality concerns
  – World heritage sites
  – Inhabitants
  – Problems outside of the city centre

• Which measures to take?
  – Present air quality?
  – Present noise levels?
  – Future EU air quality directives
  – Which vehicles/measures are relevant?

• Measure and model present air quality
  – Predict future air quality
  – Identify specific problems in specific streets
Modelling or measuring AQ?

<table>
<thead>
<tr>
<th>Model</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>- analysis of scenarios</td>
<td>- real situation</td>
</tr>
<tr>
<td>- Reliability (~input data)</td>
<td>- limited in time &amp; space (and budget)</td>
</tr>
</tbody>
</table>

Combined approach
Measurements

5-6 sites during 4 weeks:
• $\text{PM}_{10}$ Partisol (EU reference methodology)
  – $\text{PM}_{10}$ concentration
  – Black smoke
• Mobile lab (1 week at each site)
  – NO/NOx
  – $\text{PM}_{10}$ & black smoke (TEOM-FDMS monitor)
• $\text{NO}_2$ with passive samplers

10-20 sites during 1 week (or monthly average)
• $\text{NO}_2$ (passive samplers including some organic pollutants)
• Short PM measurements
• Mobile mapping (bicycle)
NO₂, model/measured values

The graph shows the monthly average NO₂ values (μg/m³) for different locations (Lokatie). The data is represented by bars for each location, with the x-axis indicating the months (1 to 26). The y-axis represents the NO₂ concentration in μg/m³. The horizontal lines indicate the model/measured values for comparison.
2003, air quality (NO$_2$)
2003, NO$_2$ P99.79
Dispersion of pollutants in a street canyon
Gentbrugge
PM$_{2.5}$ (2003)
concentrations of PM2.5 μg/m²
2003, NO$_2$, in canyons in Bruges
Ezelstraat/Guldenvlieslaan
2003, NO$_2$

- Sint Jorisstraat
- Kalkovenstraat

- Clear Canyon-effects
- Important?
2003, historical centre NO₂
2003, PM$_{10}$
2003, PM$_{10}$
daily limits are frequently exceeded (》》35x 50µg/m3)
2003, PM$_{10}$

# exceedences in the canyons
Model predictions
2012, PM$_{10}$ annual average
Model predictions
2012, PM$_{10}$, exceedences
Policy measures

- **NO₂**: no major problems expected
- **N31**: major problems
  - noise
  - Heavy vehicles
  - speed / congestion
  - new stadion
- **PM** “problems” with daily limit value
- **2012**: good air quality/noise possible but:
  - Ring/N31
  - Canyons centre
  - Heavy vehicles
    - Buses
    - Coaches
    - Trucks
Measures discussed

Voorbeeld functie
• Automatische meting luchtkwaliteit
• Informatiebord
• Vergroening stedelijke vloot
• Geavanceerde voertuigen
  – Elektrisch (fiets, Segway)

Snelheid/congestie
• ISA
• Doorstroming bruggen

Technisch
• Geavanceerde bussen
• % hybriede voertuigen
  – Parkeerbeleid

Volumes
• Fiets
• Promotie OV (1-dag)-toeristen
• Carpool/Telewerk
• Bedrijfsvervoerplannen
• Uitbreiden Cambio (andere centra)

Canyons
• LEZ (low emission zone)
  – Lengte/tonnage beperking
  – Verplichte roetfilter (HDV)
  – Politiecontrole (heavy smokers)
• Voetgangerszone
• Fietstrajecten
Evaluatie mobiliteitsplan: voorstellen
Luchtkwaliteit

ضرورة

Aanbevelingen VITO zullen de leidraad zijn van het beleid voor de komende jaren in de relatie mobiliteit – verkeer – luchtkwaliteit.

Realisatie concrete maatregelen voorgesteld door VITO:
- invoering van milieuveenvriendelijke hybride bussen
- gebruik van propere brandstoffen en motoren
- vergroening van het stedelijk wagenpark
- concrete opvolging van de luchtkwaliteit door het stadslabo
Is this the Way forward to Sustainable Development and Market Opening?

• Who did we convince?
  – Bruges city council

• How were they convinced?
  – Continuation of successful mobility policy
  – Simultaneous concerns on noise/air quality
  – The desire to be first/best
Conclusions (AQ)

• Combination of measurements & models yields reliable results
• Present AQ in the city centre is good (and better than most other Flemish cities)
  – No problems with NO₂ (concentration below annual average and hourly limits)
  – Daily limit for PM10 is frequently exceeded in most places in and around Bruges (up to 60x each year)
• Important improvements are possible by 2012
  – Cleaner cars introduced under European legislation
  – Local policies
  – Daily limit value for PM10 *may* be met in Bruges
• Additional local policies and measures are necessary to avoid exceedences in 2012
  – In street canyons (with increasing bus traffic)
  – On regional roads (road transport of sea containers)
Conclusions (mobility)

- First hybrid bus will be operational in 2008
- 4 more buses operational early 2009 at the latest
- Ensure
  - Continued growth of urban bus transport
- Avoid
  - Complaints on odour & noise