Need for a holistic assessment of urban mobility measures

- Review of existing methods and design of a simplified approach -

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mobil.TUM 2014
International Scientific Conference on Mobility and Transport
Sustainable Mobility in Metropolitan Regions
Assessment urban mobility projects

- **Why** do cities need a holistic approach for (ex-ante) assessment?
- **What** is the current practice?
- **Which** measures do cities need to assess?
- **How** can be done?
WHY

do cities need a holistic approach for (ex-ante) assessment?
The Challenge

- Local air pollution
- Municipal budget
- Accessibility
- GHG emissions
- Congestion
- Attractiveness
- Public health
- Liveability
- Safety
- PT reliability
- Road expansion
- Advanced PT passenger information
- Improved information
- Cycle lane
- People friendly streets
- Public awareness campaign
- Bicycle parking facilities
- City toll
- CNG buses
- Diesel buses
- Electric buses
- Bus priority
- LRT
- Accessibility
- Safety
- Public awareness campaign
- Municipal budget
- Road expansion
- People friendly streets
- Public awareness campaign
- Lifeability
- Safety
- Public awareness campaign
WHAT

is the current practice?
Existing methods for transport project appraisal (from a city perspective)

Cost-benefit analysis (CBA)
- Highlights economic efficiency
- Extensive data needs
- Difficulties in monetization
- Dominance of travel time savings

Multi-criteria analysis (MCA)
- Applicable to soft measures
- Allows to include qualitative impacts

The major challenge is data availability.

The major challenge will be to monetise qualitative externalities and not-clear impacts.

Financial viability checks are conducted for important projects but no CBAs.
WHICH measures do cities need to assess?
Sustainable urban transport measures

CBA

Yes

Congestion charge:
- Prud’homme and Bocarejo (2005), Transport for London (2007), → London
- Rotaris et al. (2010) → Milan

Cycling infrastructure:
- Sælensminde (2004) → Norway
- Gotschi (2011) → Portland
- Guo and Gandavarapu (2010) → Dane County

Bus priority:
- Gardner et al. (2009)

People friendly streets:

No
HOW

can it be done (better)?
The proposed approach

- Simplified method based on MCA and optional CBA
- Steps:
  1. Describe project and alternatives
  2. Identify effects and indicators
  3. Impact assessment
  4. Normalisation
  5. Criterion weighting
  6. Visualisation and interpretation
  7. Sensitivity analysis
  8. Communicate results

<table>
<thead>
<tr>
<th>Effects</th>
<th>Impact* (assessment duration, 14y)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diesel buses</td>
</tr>
<tr>
<td>Bus purchase</td>
<td>-€6.22m</td>
</tr>
<tr>
<td>Refilling station</td>
<td>0</td>
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<tr>
<td>Fuel costs</td>
<td>-€4.39m</td>
</tr>
<tr>
<td>Maintenance</td>
<td>-€2.43m</td>
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<td>NOx emissions</td>
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<td>CO emission</td>
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<td>HC emissions</td>
<td>93t</td>
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<td>PM$_{10}$ emissions</td>
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<td>CO$_2$ emissions</td>
<td>60.2kt</td>
</tr>
<tr>
<td>CH$_4$ emissions</td>
<td>2.33t</td>
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<tr>
<td>N$_2$O emissions</td>
<td>0.04t</td>
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<tr>
<td>Noise (qualitative)</td>
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<tr>
<td>External city image (ql)</td>
<td>1</td>
</tr>
<tr>
<td>PT user comfort (ql)</td>
<td>-4</td>
</tr>
<tr>
<td>PT non-user comfort (ql)</td>
<td>-5</td>
</tr>
</tbody>
</table>
Normalisation

- Translate the performance figures to a comparable scale
- Maximum score approach:

\[ Score \ C1(A) = \frac{\chi_{C1(A)}}{\chi_{C1(mox)}} \times F_{scale} \]

- Example:

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Impacts</th>
<th>Normalised score</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Diesel</td>
<td>CNG</td>
</tr>
<tr>
<td>Investment</td>
<td>-€6.22m</td>
<td>€9.72m</td>
</tr>
<tr>
<td>Operation/Maintenance</td>
<td>-€6.82m</td>
<td>€5.95m</td>
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<tr>
<td>CO₂ emissions</td>
<td>-60.2kt</td>
<td>-57.6kt</td>
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<tr>
<td>Passenger comfort</td>
<td>-4</td>
<td>-1</td>
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</table>
## Example - Results

<table>
<thead>
<tr>
<th></th>
<th>Impacts</th>
<th>CBA</th>
<th>Normalised score</th>
<th>Weights</th>
<th>Weighted normalised scores</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Diesel (BAU)</td>
<td>CNG</td>
<td>Diesel</td>
<td>CNG</td>
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<tr>
<td>Monetary</td>
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<tr>
<td>Investment</td>
<td>- €6.22m</td>
<td>-€9.72m</td>
<td>-€3.5m</td>
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<td>-10</td>
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<tr>
<td>Maintenance</td>
<td>-€2.4m</td>
<td>-€3.6m</td>
<td>-€1.1m</td>
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<td>-10</td>
</tr>
<tr>
<td>Fuel expenditures</td>
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<td>-€2.4m</td>
<td>+€1.9m</td>
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<td>-5.4</td>
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<tr>
<td>GHG emission</td>
<td>-€1.22m</td>
<td>-€1.16m</td>
<td>+€0.06m</td>
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<td>-9.6</td>
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<td>Local air pollution</td>
<td>-€5.4m</td>
<td>-€4.6m</td>
<td>+€0.8</td>
<td>-10</td>
<td>-8.4</td>
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<td>Economic results</td>
<td>Σ -€19.6m</td>
<td>Σ -€21.4m</td>
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<td></td>
<td>BCR: 0.63</td>
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<td></td>
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<tr>
<td>Non monetary</td>
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<td></td>
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</tr>
<tr>
<td>Noise</td>
<td>-6</td>
<td>-2</td>
<td>-10</td>
<td>-3.3</td>
<td>10</td>
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<td>External city image</td>
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<td>+3</td>
<td>3.3</td>
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<td>9</td>
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<td>Passenger comfort</td>
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<td>-1</td>
<td>-10</td>
<td>-2.5</td>
<td>5</td>
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<tr>
<td>PT non-user comfort</td>
<td>-5</td>
<td>-1</td>
<td>-10</td>
<td>-2</td>
<td>4</td>
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<td><strong>Overall scores</strong></td>
<td>-699.5</td>
<td>-607.2</td>
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</tbody>
</table>
## Conclusion

- No standard method for transport project appraisal exists among European cities.
- A combined approach for the appraisal of local transport measures:

### Needs to

- Reflect different kinds of impacts (holistic approach)
- Applicable to the majority of urban mobility policies/measures
- Able to reflect economic viability esp. of large scale projects (CBA optional!)

→ Further work is required to test the method and its influence in the decision making process.

### Addressed by

- Allows to include quantitative (monetary) and qualitative effects
- Efforts can be adapted to the magnitude of the measure under investigation (in terms of costs)
- An economic assessment can be integrated (supplementary, not replacing holistic results)
THANK YOU

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References (extract)

Example - Results

The graph illustrates the results comparing diesel buses and CNG buses across different criteria:

- **Direct criteria**
- **Environmental criteria**
- **Socio-economic criteria**
- **Total**

The graph shows a comparison of the performance of diesel and CNG buses based on these criteria.